

**SPECIAL EDITION 2014**

# Energy Outlook

*Aligning Qatar's R&D Stakeholders?*





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## As Qatar's Energy R&D Strategy Evolves from Concept to Implementation, Let's Add Some Serendipity

**IN RECENT YEARS**, the term serendipity has become the latest buzzword around innovation.

For it is through serendipitous moments—in other words: the accident of finding something good or useful while not specifically searching for it—that some of the world's most important scientific breakthroughs were achieved. The 'accidental' discovery of the cholera vaccine in 1879 by French chemist and microbiologist Louis Pasteur is a case in point.

In Silicon Valley, tech companies such as Apple, Google and Yahoo have been among the first to recognize the potential of serendipity in innovation – and to act on it. Among the initiatives: new buildings are being designed to trigger “casual collisions” of the work force that bring about the “aha” kind of moments that potentially lead to innovation breakthroughs.

Qatar Science & Technology Park (QSTP), already home to numerous research and development (R&D) labs set up by local and international energy companies, has the potential to fulfill a similar role in the regional energy sector. To be sure, industrial R&D that produces bread-and-butter-type innovations for companies will always have to have a large element of structure and focus to it.

But as Qatar's energy R&D ambitions shift from concept stage to implementation following the announcement of the three research priority areas of energy, water and cyber security in November, adding an element of serendipity may take its efforts to the next level.

**Sean Evers**

Managing Partner, Gulf Intelligence



WHITE PAPER:  
Qatar R&D - Grand  
Challenge Under Scrutiny

**Gulf Intelligence**

**INTRODUCTION**

Qatar’s plans to establish itself as a global research and development (R&D) center have progressed at a satisfactory pace over the past 12 months and provided new guidance on what direction local R&D activities should take as the national research strategy shifts from conceptual to implementation mode. But the recent announcement of the Gulf state’s three research priority areas has also raised new questions, in particular among energy industry stakeholders.

In a survey conducted at The Gulf Intelligence Energy R&D Forum in Doha among nearly 150 leaders from academia, government and industry, 57 percent of respondents expressed the view that general progress made by Qatar in becoming a global energy R&D center over the past year had been as fast as expected, while 12 percent thought progress had been faster than anticipated. About a third of respondents thought progress had lagged behind expectations.

The survey also found that 41 percent of respondents believed the next 12 months should see Qatar place a stronger focus on higher education and launch more PhD programs to advance the country’s R&D plans, while 40 percent thought it would be most important to implement initiatives aimed at driving more private-sector engagement as these would encourage entrepreneurship and—subsequently—the creation of an innovative environment supportive of R&D.

The remainder of respondents expressed the view that greater emphasis should be placed on developing a regulatory framework that includes the provision of intellectual property rights. The survey results give a good indication of the largely positive sentiment surrounding Qatar’s R&D strategy and of what stakeholders believe would be the appropriate next steps to further advance the country’s research goals into 2015 and beyond.

The findings follow Qatar Foundation’s keenly anticipated announcement late last year that it had identified three grand challenges—energy security, water security and cyber security—that national and international R&D stakeholders should prioritize in the near term to produce tangible research results for the Gulf state on its quest towards becoming a knowledge economy.

**QUESTION 1** How would you describe the progress that has been made by Qatar over the past 12 months in its quest towards becoming a global energy R&D hub?

- 1) Faster than expected
- 2) Slower than expected
- 3) As expected

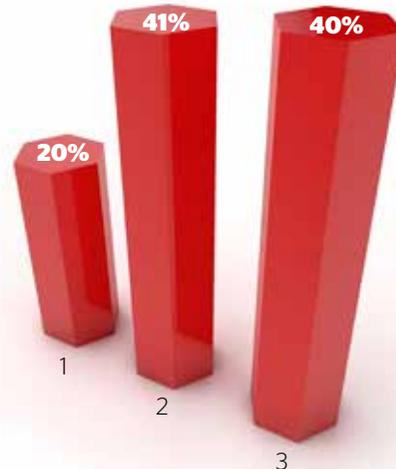


**RECAP**

Innovation and R&D have become top priorities for all governments in the Gulf region in recent years amid recognition that in an increasingly globalized world, a country’s competitive edge and ability to attract foreign investment will largely be determined by its ability to gain competitive advantages through innovations. Qatar is seeking to establish itself as a center of energy R&D in line with its National Vision 2030, which aims to transform the Gulf nation from a hydrocarbons-based economy into a knowledge economy.

**QUESTION 2** What are the most important initiatives that Qatar should focus on next to advance its energy R&D ambitions over the next 12 months?

- 1) Regulatory - the introduction of Intellectual Property Rights
- 2) Education - focus on launching more PhD programs
- 3) Private Sector Engagement - encourage entrepreneurship as it will add value to domestic resources



To this end, the establishment of the Qatar Science and Technology Park (QSTP) in 2008 was a landmark that has since been followed by a string of initiatives and programs across government, academia and industry in support of R&D.

For the first time, Qatar in November held its Annual Research Conference (ARC), which seeks to establish a platform that brings together leading scientists and researchers to encourage and drive multidisciplinary collaboration. In October, Qatar Foundation Research & Development (QF R&D) and Hamad Bin Khalifa University (HBKU) introduced the country’s first—and long-awaited—PhD program in Energy Sciences, while Qatar University earlier this year opened several new research centers, including one for sustainable development. These developments follow the establishment of a Masters of Chemical Engineering program at Texas A&M University at Qatar.

At the same time, international energy companies have extended their footprint at QSTP and have begun carrying out research into numerous areas such as environment, water reuse, energy efficiency and enhanced oil recovery (EOR) among others. In short, Qatar’s R&D plans have gathered momentum and seen a significant capacity build up, both in terms of human and technical capacity, over the past five years.

**PRIORITIZATION**

It was at the ARC 2013 in November that Qatar Foundation announced the three grand R&D challenges to be addressed as a priority going forward, having narrowed them down from an original 72 objectives. While the prioritization of the local research goals was widely welcomed by all stakeholders as an important next step for Qatar to realize its R&D ambitions, it also raised questions over the scope and definition of the grand challenges.

Energy security in particular has come under closer scrutiny by local and international energy companies seeking closer alignment with QF R&D and other stakeholders on the one hand in order to make sure their research meets national objectives; on the other hand, energy companies—and international oil companies (IOCs) specifically—will have to meet their own corporate mandates and objectives

determined in part by the need to generate returns on their R&D investments and broader technology requirements in the sector.

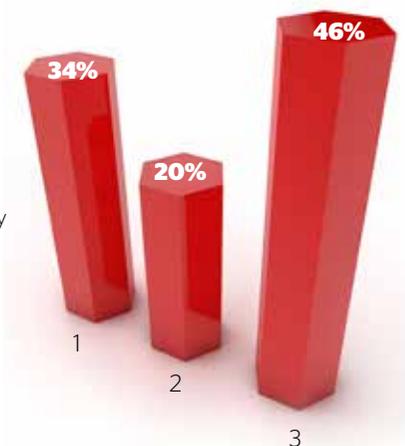
With this in mind, concerns have been voiced that the current definition of energy security within the grand challenges might be too narrow and thus lead to a situation where two parallel research tracks may emerge in Qatar – one led by QF R&D and one led by the energy hydrocarbon industry, which has a very large footprint in the Gulf nation.

“Are we concerned about loss of alignment, because the mandate for the oil and gas industry would be different from the mandate of QF R&D, and we end up with two parallel tracks of research rather than alignment and collaboration?” asked Dr. Eyad Masad, Assistant Dean for Research and Graduate Studies at Texas A&M University at Qatar (TAMUQ) at the forum.

There is generally consensus that the definition of energy security is quite broad. For oil and gas exporters such as Qatar, which has grown into a major hydrocarbons consumer in its own right in the recent past, energy security is relevant for two reasons: it needs to meet rapidly-rising local demand through conventional as well as alternative energy sources such as renewables; and it needs demand security for its exports from consuming nations. Energy consumers meanwhile seek a reliable, stable and sustainable supply of energy at affordable prices. For the energy industry, notably the IOCs and national

**QUESTION 3** In successful economies, innovations are fostered and prepared for market within robust, supportive environments - ecosystems - that catalyze enterprise formation. What is the most important contribution the energy industry can deliver to create this environment in Qatar?

- 1) Drive in-country R&D through to commercial implementation
- 2) Locate mission critical research labs in Qatar that support global operations
- 3) Cooperate and coordinate with industry peers on research that has an impact for Qatar



“The debate implies the potential need for additional communication channels and platforms in a bid to achieve more clarity and the best possible alignment between all stakeholders.”

oil companies (NOCs), energy security also means operations—and asset—integrity.

The different perspectives and definitions naturally give rise to questions over the nature and relevance of R&D to be carried out by energy companies in Qatar and the potential limitations they may face within the context of the energy security grand challenge. With the original definition of energy security as a grand challenge very much centered on solar energy, research mandates appeared potentially limited when they were announced in November.

“They started out around solar power. Then I saw this widen up. And I think that’s useful. If we don’t pigeonhole the definition of energy security, then there’s a lot of space within that for different organizations who have different stakeholders and different remits for what they need to be doing,” said Dr. Andrew Wigton, Research Director at the ExxonMobil Research Center, located at QSTP.

The question, debated at the forum to some length, specifically is what Qatar Foundation’s rationale was for not including hydrocarbon research into or making it a grand challenge, and what the consequences of not doing so are for energy companies active on the ground. Hydrocarbons sit at the heart of Qatar’s economy, accounting for the bulk of the country’s gross domestic product (GDP) and government revenues, making maximization of reserve recovery and efficiencies a top priority, industry officials partaking in the debate said.

According to Dr. Thomas Zacharia, Executive VP of R&D at Qatar Foundation, there were good reasons as to why hydrocarbons were not included in the initial set of grand challenges.

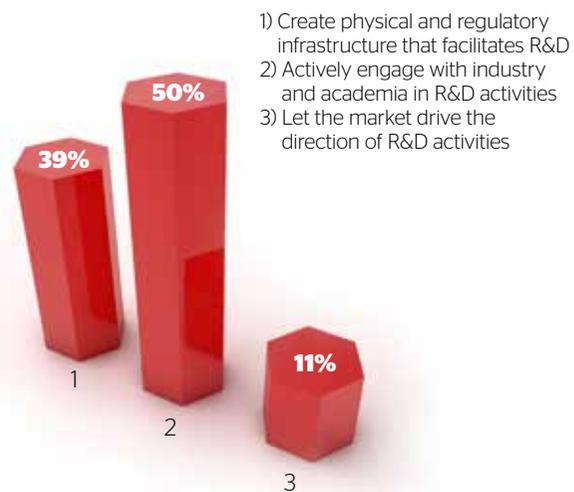
“It is a core of the economy of this country, which means that there are lots of considerations in terms of what research area we tackle and what are the mechanisms to deal with proprietary research, because this is of tactical and strategic importance, and has financial and economic implications on the country,” he said.

“We need to hear from [industry] that this

[hydrocarbons] is something very important for Qatar to pursue. It’s very much in the grand challenge because to me, it is important for the research enterprise here to be aligned with the main source of revenue, the industry here, but it also means that the industry has to say this is important. It’s one thing to say we need to work on hydrocarbons, but probably we need to focus on saying is it, for example, to find out whether you can enhance oil recovery. If that is something of interest, we will support it and we will work with [industry] on that. That’s something we need to hear from industry.”

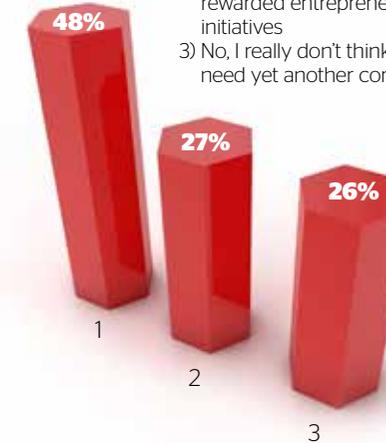
The debate implies the potential need for additional communication channels and platforms in a bid to achieve more clarity and the best possible alignment between all stakeholders. However, even if these were to be established, IOC-IOC-type collaborations in particular will continue to be a challenge to implement, if core business areas are involved due to concerns over sharing proprietary technologies.

**QUESTION 4** In R&D, the government has some role to play - generally speaking, what should that role be?



**QUESTION 5** Would setting up an industry committee dedicated purely to the coordination of energy R&D in Qatar go a long way to facilitating alignment between energy R&D stakeholders - national and international?

- 1) Yes, if a national institution defined & led the initiative
- 2) Yes, if it encouraged and rewarded entrepreneurial initiatives
- 3) No, I really don't think we need yet another committee



At the same time, the fact that national resources—oil and gas fields in Qatar’s case for example—are involved, means that sensitive information may need to be accessed, which companies may legally be unable to share, thus ruling out certain types of research related to hydrocarbons.

“There’s a lot of sensitivity around how many people can see that data and work with those data sets. It’s not always easy to work collaborations in that area because it is just that sensitized. That’s something I think is going to be a barrier,” said one forum participant.

Interestingly, and despite this challenge, almost half of the respondents participating in the industry survey expressed the view that cooperation and coordination with peers would be the energy industry’s most important contribution to create an environment conducive to generating research that produces tangible outcomes for Qatar.

Still, there appears to be a widely-held view that to align national and international energy R&D stakeholders’ mandates successfully in the long term, dedicated platforms will need to be created that help identify the areas where collaboration for joint industry projects is most feasible and promising in terms of producing locally-relevant results.

This will have to be complemented by the introduction of clear procedures and regulatory frameworks that address issues including intellectual property rights and the

commercialization of research among others.

It therefore doesn’t come as much of a surprise that 50 percent of all survey respondents indicated that the government has a key role to play in R&D by actively engaging with industry and academia, while 39 percent thought the role of the government should be to create the physical and regulatory infrastructure that facilitates R&D. Only 11 per cent of those surveyed said the government should let the market drive the direction of R&D activities .

This does not mean that QF R&D or the Qatar National Research Strategy will dictate the research to be performed by the industry or universities. Both have distinct strategic objectives and targets, with academic research often being ‘blue sky’ with a goal to enhance global knowledge and sharing this through publication. Industry is motivated by business factors, or—in other words—commercialization.

“However, there are examples where industry and academia or national institutes like Qatar Environment & Energy Research Institute (QEERI) can work together,” said Dr. Zacharia. “One example in the U.S. is something called the Cooperative Research and Development Agreement. This is where industry identifies a critical priority area and they see value in collaborating. The framework allows you to do the research in a proprietary way, so that the outcome of the results is not published but rather protected to advance the interest of industry. I think in the coming months, based on this discussion today, we will pursue what, if any, mechanisms or strategic alignment we need to have in order to address these goals.”

Going forward the goal will therefore be for national and international energy stakeholders to further explore ways of aligning their strategies and establishing collaboration platforms that meet the criteria of the grand challenges. The latter—and energy security in particular—in turn will have to be broadened in their scope to ensure that energy companies’ requirements and remits can be closely aligned with Qatar’s national R&D objectives. And yet, not all research carried out in Qatar may fall under the grand challenges umbrella.

“I think that everybody is going to be doing a lot of things and one of the challenges is identifying those areas that are right for collaboration – if what you want to do is enhance your collaborative environment. But you can’t expect that everything is going to be done under the tent,” said Dr. Wigton. ■



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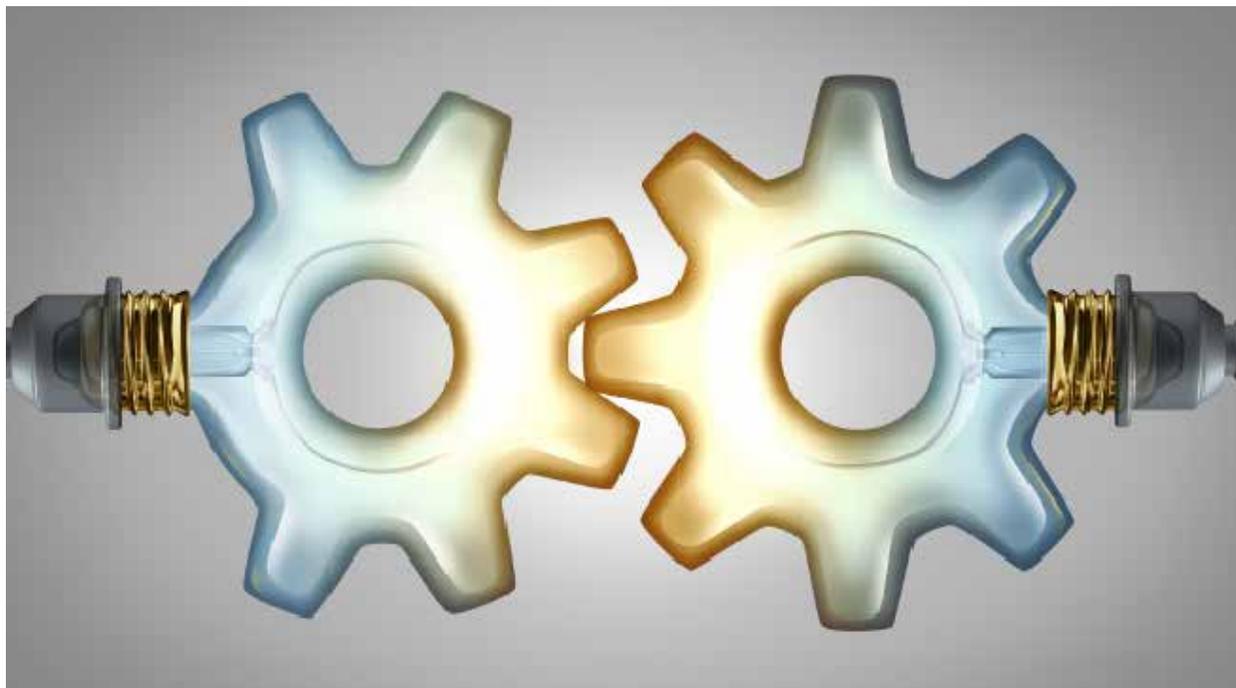
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## STAKEHOLDER ALIGNMENT



Technology and Innovation  
Will Underpin Qatar's  
Energy Development for  
Many Years to Come

**Hamad Rashid Al Mohannadi, CEO, RasGas Company Limited  
and Chairman of the Board of Regents, Qatar University**



**LOOKING BACK** to the early 1990s, Qatar's oil and gas production was just about 400,000 barrels per day. Its economy had a size of just about \$7.5 billion and the country's population was below 500,000.

Much has changed since. Today, Qatar is the world's largest exporter of liquefied natural gas (LNG); oil and gas production has multiplied tenfold to just over 4 million barrels per day of oil equivalent; and the population has quadrupled to over 2 million people. Qatar's gross domestic product was above \$180 billion in 2013 – 10 times versus a decade ago. And while Qatar is wisely pursuing opportunities to diversify its economy, the energy sector will continue to play a key role for years to come.

The hydrocarbon reserves that have fuelled this incredible growth have been in place for centuries, but in the past 50 years, technology has been the key to unlocking and commercializing the vast gas resources in the Qatar North Field. In many cases, the technology required to effectively monetize Qatar's resources had to be developed. And this was done successfully—time after time—through collaboration between local operating companies, international oil companies and technology providers.

Taking Qatar's LNG development as an example, research and development has been involved at each step of the value chain. Acid gas simulation technologies have helped us optimize gas extraction methods, employing mega LNG liquefaction trains with capacities

reaching 7.8 million tons per annum. The use of this technology allowed RasGas to maximize production in a relatively short span of time. Another example is the Q-Max and the Q-Flex vessels. These LNG carriers allow Qatar to transport huge volumes needed to effectively and reliably meet our customers' energy needs.

The role of technology and innovation doesn't end with the inauguration of projects. The potential for advances in technology to increase recovery efficiency, even in small increments, will have huge impacts on the ultimate value extracted from Qatar's natural resources. The industry will provide our future generations with impressive opportunities. But these exciting prospects come with serious responsibility.

We have to protect our environment by developing more efficient and cleaner methods to extract, process and transport our products with less waste, less emission and less spill risk.

Improving cost-optimization, reliability, and environmental friendliness need to be strategic focus areas for our industry. The increasing availability of unconventional gas also drives us to be innovative in keeping LNG—and specifically Qatar's LNG—competitive in the global energy market.

Qatar visionary leadership knows that the State's future lies in the decisions we make today. In that wisdom, it has facilitated the development of the key building blocks needed to create an environment where

research and development can be successful. We now have strategic partnerships with carefully selected industry players. We also have a higher education system that leverages the best of our local institutions and international universities, with proven track records of ambitious research and development initiatives. Together, they focus on strategic disciplines such as engineering, computer science, design, and medicine, to realize the country's vision.

To help set the direction for and facilitate research and development efforts, Qatar is blessed with a number of rooted establishments that enjoy strong financial backing: Qatar Foundation, Qatar University, Qatar National Research Fund, Qatar Science & Technology Park and Qatar Energy & Environmental Research Institute.

I see three main focus areas ahead of us, as leaders in industry, academia, and institution policy-makers: The first is effectiveness and efficiency. We need to make sure that the building blocks, that have been provided, are brought together in the right way to enable effective collaboration between our organizations and for successful research and development initiatives.

The second is to establish a well-aligned portfolio of objectives and priorities. Qatar National Research Fund has established a framework for these with the challenges of energy, water and cyber security. But we, as an industry with our partners in academia, need to work together and with Qatar National Research Fund to further define the specific challenges that oil and gas production will target and the role research and development will play in meeting those challenges.

The third is encouragement and engagement. Appropriate business models that include all parties through shared investment scenarios, fair and creative intellectual property strategies and a well-established legal framework around these issues will minimize risk and uncertainty, and provide the right motivation for all parties to participate and ultimately be successful.

In my role as CEO in RasGas and chairman of the board of trustees of Qatar University, I have had the good fortune to witness several examples of how this collaboration between key stakeholders can work. RasGas has partnered with Qatar Petroleum, international oil companies, Qatar University and Texas A&M University at Qatar in the development of technologies that

“The role of technology and innovation doesn't end with the inauguration of projects. The potential for advances in technology to increase recovery efficiency, even in small increments, will have huge impacts on the ultimate value extracted from Qatar's natural resources.”

will directly benefit RasGas operations, by monetizing resources, improving efficiency, operations integrity and reliability, to assure safe and uninterrupted gas delivery to our customers around the globe.

At the same time, through collaborative efforts, Qatar University laboratories have been enhanced with state-of-the-art equipment, and students are being given the opportunity to apply their skills in tackling real-world challenges facing our industry. So these partnerships can work and add tremendous value.

Energy is a key component of the recently launched Qatar University Research Priorities. And the research output of its Gas Processing Center, its Environmental Studies Center, and its Center for Advanced Material are but a few examples of the productive partnership between the energy sector and the national research agenda, of which Qatar University is a vital constituent. Their numerous collaborative efforts with the industry and its outreach activities with schools aim to cement a research culture among our youth that is integral to the development of a knowledge economy.

Now, the question before us is how to establish these partnerships and facilitate their effectiveness through sound policy and process development. ■



**Hamad Rashid Al Mohannadi, CEO, RasGas Company Limited and Chairman of the Board of Regents, Qatar University**



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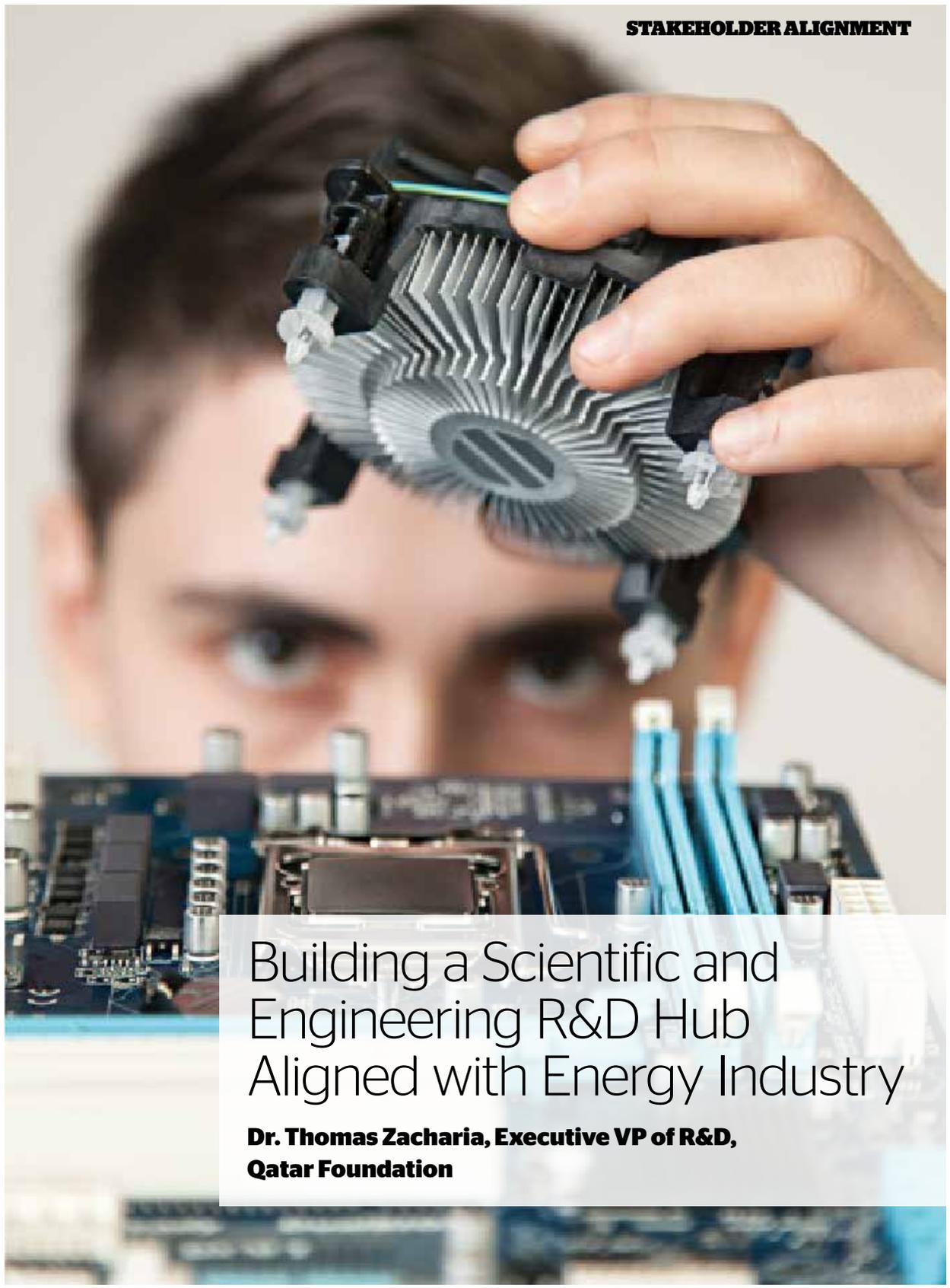
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## Building a Scientific and Engineering R&D Hub Aligned with Energy Industry

**Dr. Thomas Zacharia, Executive VP of R&D, Qatar Foundation**



**INVESTMENT** in research and development (R&D) can be considered as buying down the risk that a country or organization faces. For Qatar, the reason for investing in R&D is to achieve, or help achieve, the National Vision 2030, which is to create a diversified economy. There are a number of ways to get there – R&D is one contributing factor.

Education and research are often viewed as two separate activities, but they're very much a holistic activity. A research-intensive university helps train students not only for today's jobs, but also for tomorrow's. This is one way of buying down the risk as a nation looking to the future, to develop a cadre of people who're invested in the future to tackle important challenges.

As for the Qatar National Research Strategy (QNRS), one of its key goals is to support the Qatar National Vision 2030 to build a world-leading research and innovation ecosystem. What does it take to build this kind of ecosystem?

Scientists do not commit 30 years of their

lives if they don't believe that the problems are worthy of spending these years. So what's needed is to focus on important challenges that motivate youngsters who're going to bet their career--spend 30 years on solving these problems. Qatar has very important challenges that have been identified through QNRS via engagement with key stakeholders.

Energy security is one important challenge. It is not just a Qatar problem; it is a global challenge. But Qatar is in a unique position to tackle challenges and make important contributions to solving them. Water is an equally important challenge. One may argue it's even more of a challenge than energy and it's a particular challenge in Qatar in terms of both consumption as well as generation of water. As for cyber security, Qatar is the largest supplier of natural gas to the entire world. Protecting and preserving this infrastructure so it can continue to support a prominent international role is seminal. A disruption wouldn't just be a Qatar problem but a global one.

# AUDIENCE Q&A: With Qatar Foundation R&D

**Abdulrahman Al Emadi, Head of Maersk Oil Research and Technology Centre**  
**Maha Al-Mannai, University Collaboration Manager, Qatar Shell Research & Technology Centre**  
**Dr. Thomas Zacharia, Executive VP of R&D, Qatar Foundation**

**Abdulrahman Al Emadi** With a number of energy companies striving to attract Qatari nationals to work in R&D, what can we do to attract those students to come and work in the R&D sector? And how do we bring the world's top researchers to come to Qatar and have them mentor Qatari talent?

**Dr. Thomas Zacharia** Success begets success. Why do Qataris prefer to go into the oil and gas sector – because it is viewed as pursuing a successful career. So we need to make R&D a successful career path and an attractive career path. No one commits to 30 years in what is viewed as an unsuccessful career path.

I grew up in a culture not that dissimilar from Qatar, in the southern part of India, and was given two choices: be an engineer or be a doctor. That wasn't a good option for me and that's how I became an engineer. The field of research opened up to me only when I went to North America. Even then my thinking was that I'll get my PhD, it will look good on my CV and then I'll go back to India to work for the family business. But I got hooked when I did a two-year post-doc at Oak Ridge National Laboratory. I saw the world open up to me. Why? Because I had the best facilities and best instruments with which to do research. Only my imagination was the constraint. I could conduct research better than what anybody else. Second, I had great mentors. And three, I had the benefit of great scientific talent visiting with us.

So I will use the same as a reason



why would scientists come here. Scientists would come to Doha because we have important problems. Scientists would come here because there's commitment at the leadership level. Scientist would come here because there are financial resources. But, most importantly, scientists will come because we have the facilities and they have collaborators at the university, as well as within the research institutes and industry that they can work with.

It's our job to create that innovation enterprise. But it's also a catch 22. Without the ecosystem, no Qatari will decide to pursue R&D. It's just like without the petrochemical industry, nobody will go into the petrochemical industry. So together we have to develop the ecosystem, then people will follow. There is lot of successful scientific talent in Qatar. We need to celebrate them, celebrate their successes so that the next generation feels that this is a worthwhile area to pursue a career.

**Ms. Maha Al-Mannai** Do you see the need to establish new platforms that bring together key stakeholders for specific goals of advancing and deepening collaboration between the universities and industry?

**Dr. Thomas Zacharia** My experience is that both within an institution as well as between institutions we need communication, communication, communication. It's the key, in terms of alignment and in terms of figuring out how to work with each other. The short answer to the question is that forums, including the National Research Strategy Forum and the Annual Research Conferences, are key avenues for these engagements. Currently, we are sort of staying at the 20,000 feet level. On the high level everybody can agree. But we need to begin tackling the specific challenges in terms of how we can engage.

I would also add that we need to bring in the university in this component. Because one way to look at is to say—instead of the petrochemical industry and R&D and university competing for the same Qatari students—maybe what we need to do is identify a common cost and say we will jointly recruit this student. We will give this student research opportunities, and when they finish their PhDs, they will have the wide array of opportunity. They can go into industry or go into one of the research institute so they can be a professor at a university. So there are a number of options and I would certainly welcome the opportunity to engage in this topic.

“ But, most importantly, scientists will come because we have the facilities and they have collaborators at the university, as well as within the research institutes and industry that they can work with.”

When we at Qatar Foundation (QF) looked at the number of challenges, we chose to focus on a few grand challenges that can deliver both near- and long-term impacts. We arrived at these grand challenges—energy, water and cyber security—by looking first at whether there was a national commitment in terms of renewable energy on the grid, water in terms of a major national challenge, and cyber security. These three areas emerged as important for Qatar’s research focus.

As a research organization, QF R&D cannot simply take on a challenge unless there is stakeholder commitment. These three areas were identified as stakeholder commitments that the nation wants to pursue and solve. So we asked: Is there enough industry or other agency engagement and interest in these areas? Do we have the intellectual capital in Qatar and the resources to tackle these challenges? These are two of the criteria that we used to identify the grand challenges.

But we are not going to stop there. In fact, a dozen grand challenges were identified as part of the 2030 QNRS discussions. These strategies aren’t intended to be static but rather to evolve with time through continued stakeholder engagement. We’re not going to do only three things for the next 20 years. But we need to make sure that the problems we address are important and that we have the resources and the capacity to achieve our goals.

The next question is – how do you translate science into innovation? Ultimately, academia and research institutes don’t solve these

problems without engaging with the private sector. Industry is where the rubber meets the road. Qatar Foundation R&D is engaged in many ways and we need to continue building this momentum. But we need to facilitate knowledge and technology transfer in both directions because if we don’t understand the critical problems faced by the energy industry, we aren’t likely to focus on those problems. Likewise, we need to work with industry to raise awareness of what our capabilities are and who the key scientific staff is to deliver them. We need to assist the growth of small and medium enterprises, because they can then support the major industry sector. This is one way to diversify the economy. And, of course, we need to enable and optimize start-ups, which is something that Qatar Science and Technology Park (QSTP) has begun to focus on.

Another area that needs focus is the creation of a global nexus of scientific talent in Qatar. There are key elements that need to be pursued. Developing and sustaining top local PhD talent in Qatar is very important. Accordingly, the major universities, the branch campuses and Qatar Natural Research Fund (QNRF) all have an important role to play in terms of funding and supporting these PhD programs. At QF, we are committed to this goal as well.

For the size of the economy, the expectation is that Qatar needs about 10,000 researchers in order to sustain growth. On the face of it, this feels like a big challenge. But while this is a significant number, it’s a number we can work on if the full



pipeline is being targeted, from secondary school to middle school, to high school, to undergraduate, to PhD. Sometimes we have to take a long-term view to sustain this type of an activity.

Finally, what we are interested in is growing economic clusters through impactful science. So, we’re doing all the research, both the supporting research to extramural funding from QNRF at the universities, and the intramural research through the three institutes in energy and environment, Qatar Computing Research Institute, and Qatar Biomedical Research Institute.

What we need to do is to create an easy mechanism for entrepreneurs to create new clusters. People who have full-time jobs aren’t

likely to start companies. If one looks at places with vibrant entrepreneurial activity, the people who create companies are the people who’re graduate students, who’ve just come out of universities, who have the ability and the inclination to take risks. Essentially, they are the people with the lifeblood of entrepreneurial activity. One of the things that we want to attempt with stakeholders’ support at QSTP is facilitate this type of environment.

As for stakeholder alignment, it is unrealistic to expect perfect alignment in a very short period of time. But the fact that discussions are taking place is something that needs to continue in order to bring greater alignment. ■



**Dr. Thomas Zacharia,**  
Executive VP of R&D,  
Qatar Foundation



## Defining Energy Security as a Grand Research Challenge

**Dr. Andrew Wigton, Research Director,  
ExxonMobil Research Center, Qatar**

**WHEN QATAR FOUNDATION** in November announced the three priority areas for domestic research and development (R&D) activities to focus on, it ushered in the next phase in the Gulf state's quest to become a leading global research center.

With the country's near-term R&D focus on energy security, water security and cyber security, this is an important development for those participating in and supporting Qatar's National Research Strategy such as the local and international energy industry as it provides some clarity on what direction

the journey is set to take. It also offers the industry a better insight into where the potential opportunities will be in terms of leveraging existing and new research facilities, and with regard to the numbers of scientists and researchers that will be brought in and the value they will offer. This is certainly positive from an industry perspective.

Looking back to 2006, the year in which ExxonMobil launched ExxonMobil Research Qatar, there can be little doubt that the country's research sector has come a long way – both in terms of broader industry accomplishments thus far and in terms of the government creating an ecosystem that's conducive to carrying out meaningful and results-orientated R&D in the country. The fact that so many international energy companies have extended their footprint at the Qatar Science and Technology Park (QSTP) speaks for itself.

And while the prioritization of the Gulf state's near-term research strategy into three grand challenges has provided some answers, questions still remain, in particular with regard to the definition of energy security and what types of R&D activities fall under its umbrella.

The definition of energy security is fairly broad. From an energy consumer perspective, it generally refers to the reliable, stable and sustainable supply of energy at affordable prices. For oil and gas exporters such as Qatar, which at the same time is emerging as a major energy consumer in its own right, energy security is relevant both from a domestic demand perspective, i.e. meeting rapidly rising local needs, and demand security from consuming nations for its exports. From ExxonMobil's perspective, energy security is also very much about 'operations integrity', which refers to managing critical safety, security, health and environmental (SSH&E) risks inherent to the oil and gas business.

By the same token, the range of research that needs to be done to ensure energy security is equally broad. From finding and developing energy resources such as conventional and unconventional hydrocarbons to pursuing solar and other alternative energies, all the way through the value and operations chains, R&D into all these areas is integral to making sure that future developments are being carried out in a safe, environmentally responsible and sustainable manner.

“With this in mind, it will be essential to consider energy security in its broadest sense in order to enable different players who have various stakeholders and remits to continue pursuing R&D activities.”

At the same time, R&D into the efficient use of existing resources and the development of relevant technologies will be seminal to ensure future energy requirements will be met – both in Qatar and globally. With global energy demand expected to increase by about 35 percent by 2040 versus 2010 levels, advances in R&D and technology are urgently needed to address the world's energy needs and demands over the next 30 years and beyond. Without it, adequate and affordable energy won't be available to maintain economic growth and quality of life in a world that is projected to see its total population of 7 billion rise to about 8 billion in 2025 and more than 9 billion in 2050, according to the U.N. Department of Economic and Social Affairs.

With this in mind, it will be essential to consider energy security in its broadest sense in order to enable different players who have various stakeholders and remits to continue pursuing R&D activities. To be sure, R&D in Qatar needs to be relevant to the country while also keeping in mind the responsibility oil and gas companies have towards their shareholders and the general public to deliver value and develop harder-to-access hydrocarbons in a safe and reliable manner.

Similarly, government plays an important role in promoting science and technology in education, and providing incentives that encourage innovation by granting patents and creating the wider regulatory environment needed to facilitate R&D. The role of academia involves industrial research as well as valuable fundamental research.

What's important is for all stakeholders—academia, industry and government—to identify the areas of commonality in order to leverage and promote collaboration. ■



**Dr. Andrew Wigton,  
Research Director,  
ExxonMobil Research  
Center, Qatar**



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## Aligning Qatar's Grand Challenges with Energy Industry & Academic Partners?

**Dr. Thomas Zacharia, Executive VP of R&D, Qatar Foundation**  
**Dr. Andrew Wigton, Research Director, ExxonMobil Research, Qatar**  
**Dr. Hassan Al Derham, VP for Research, Qatar University**  
**Moderator: Dr. Eyad Masad, Assistant Dean for Research and Graduate Studies, Texas A&M University at Qatar**



**DR. EYAD MASAD** What progress has been made by Qatar over the past 12 months towards becoming a global energy R&D hub?

**DR. THOMAS ZACHARIA** Qatar has built a world class research enterprise and has made remarkable progress, especially in engaging with the stakeholder community, but certain challenges remain of course.

**DR. HASSAN AL DERHAM** I've been witnessing the development of the research enterprise here in Qatar for about eight years, and we had never thought that we would make such progress within this short period of time. During the last three months, several international companies have visited us at Qatar University, expressing interest in partnering with us to establish research programs and centers. They are willing to invest in Qatar, as they identify real commitment from the leadership and from the different stakeholders to work together.

**DR. EYAD MASAD** Should the Qatar Foundation grand challenges focus more on the hydrocarbon sector?

**DR. THOMAS ZACHARIA** The Qatar Foundation Research and Development Organization doesn't invent problems; we listen to the stakeholder community. So, as a scientist, I'm convinced there are important problems in the hydrocarbon area. However, there are also good reasons as to why hydrocarbons are not in the initial set of grand challenges, because they are already a core of this country's economy.

We need to look at what the mechanisms to deal with proprietary research are because this is of tactical, strategic and economic importance to the country.

**DR. HASSAN AL DERHAM** Qatar is a small country with less critical mass and so it is a big challenge to bring researchers. But small can be good, in that you can accelerate a process;

you can engage different stakeholders together, define the agenda clearly and move forward faster than some other larger countries. We have a unique position here that LNG and energy hydrocarbon resources are the backbone of the economy.

**DR. EYAD MASAD** Is there a concern that the current definition of energy security, as defined by the grand challenges, might be too narrow; that it might lead to a situation where we have two parallel tracks of research in Qatar; one led by QF R&D and one led by the energy hydrocarbon industry? Are you concerned about that lack of alignment and collaboration? Andy?

**DR. ANDREW WIGTON** We should not necessarily limit the definition of energy security as a grand research challenge to the development of alternative energy sources. Using a broader definition that includes enhanced recovery or environmental and safety performance allows space for organizations that have various stakeholders and different concerns for what they need to be doing, which is relevant in the context of the bigger picture. Government has responsibilities to undertake research, to inform policy makers and regulators. Energy companies have responsibilities to their shareholders, to their management and to the general public to make sure that projects and operations are safe and reliable. So if you create that space, you can identify areas of commonality and that's where you can start to leverage and promote collaboration.

**DR. THOMAS ZACHARIA** I think it would be a mistake to think that QF Research and Development or Qatar National Strategy is going to dictate the research that will be performed in the industry or even--for that matter--in the university. Academia awards great freedom for individuals to pursue curiosity-driven research beyond any kind of strategic direction. Industry is motivated by the success of their business.

However, there are examples where industry and academia or national institutes like QEERI can work together. One example in the U.S. is something called the Cooperative Research and Development Agreement. This is where industry identifies a critical priority area and recognizes value in collaborating in this case with, say, QEERI. The framework enables you to do the research in a proprietary way, so that the

“ I think it would be a mistake to think that QF Research and Development or Qatar National Strategy is going to dictate the research that will be performed in the industry or even--for that matter--in the university. Academia awards great freedom for individuals to pursue curiosity-driven research beyond any kind of strategic direction.”

**Dr. Thomas Zacharia**

outcome of the results is not published but rather protected to advance the interest of industry. I think in the coming months, based on this discussion today, we will pursue what, if any, mechanisms or strategic alignment we need to have in order to address these goals.

**DR. HASSAN AL DERHAM** I think there is a learning curve that we have to go through. Let's not forget that the announcement of this "grand challenge" only happened four to five months ago, and forums like this will help clarify things for all of us, all stakeholders.

**DR. EYAD MASAD** What is the role of the government sector in all this?

**DR. ANDREW WIGTON** It's good to see the Qatar Foundation Research organization moving towards a priority scheme which gives stakeholders more information on where potential opportunities may be. The number of experts they're going to be bringing in will offer valuable scientific resource that we will be able to leverage. Another advantage is clarification on direction. I see the initial three grand challenges as a focusing mechanism. The National Research Strategy is broader than the 3 grand challenges chosen for initial focus and I think it is important not to lose sight of some of these other areas...our colleagues at Sidra Hospital would hope it's broader than just what we're talking about

here today. It's also an identification process - there's a wide range of activities to be working on and having a structured way of getting to where you need to be to start is very valuable.

**DR. THOMAS ZACHARIA** One way we are improving alignment is we have reorganized the Qatar National Research Fund around the four pillars of energy and environment, computing, health and life sciences and social sciences. The appointed Associate Directors for each of these sectors are now working with the scientific community in developing requests for proposals that are much more aligned with the needs of the country. Once this is developed, they will go through the normal evaluation process, which is very much like what most funding agencies do.

**AUDIENCE MEMBER** — Dr. Mabrouk I'm with the Qatar Petrochemical Company. Most of us who have been involved in R&D in Qatar can testify to many positive developments and progress in the last 12 months or so.

I have a question for Dr. Thomas - from his interactions with the various stakeholders in the last year or so, is there one area that he would pick as a critical factor that really needs improvement?

**DR. THOMAS ZACHARIA** I would say that the engagement, given the resources and the size of the community, has been very positive. One challenge now is to ensure that we continue to engage and focus on building

“ Qatar is a small country with less critical mass and so it is a big challenge to bring researchers. But small can be good, in that you can accelerate a process; you can engage different stakeholders together, define the agenda clearly and move forward faster than some other larger countries.”

**Dr. Hassan Al Derham**



capability, and not run too fast. Continue with the process of engagement with stakeholders and highlight how we can partner and work well together. I will be in a better position to answer this question more thoughtfully in a couple of years.

**DR. EYAD MASAD** I have a question which I would like us to conclude with: If the definition of energy security encompassed hydrocarbons, would the IOCs be ready to deliver on that? Would they be ready to put the research agenda in Qatar that's relevant to the core business of the state of Qatar and not driven by headquarters and the global agenda?

**DR. ANDREW WIGTON** My answer would be that we're doing that already. We have a research center at QSTP, as do other

international companies. The energy industry is actively doing research that was chosen specifically to be of relevance to the state of Qatar. Our expectation and our vision is to continue on this path with our partners. I agree that the definition of energy security should be broadened beyond alternative energy sources. We look forward to the development of a research organization that will bring further capacity and which will give us the opportunity to be more efficient and to collectively tackle areas that perhaps we weren't able to address because the infrastructure wasn't yet in place.

**DR. HASSAN AL DERHAM** I think national companies have a greater responsibility and role here than IOCs. If you consider a company like Statoil in Norway, in the

early 70s, their situation at that time was comparable to the situation here now. Now, they have know-how and have a presence in more than 30 countries and there's no reason why our national oil and gas companies can't do the same - amalgamate activities with different stakeholders. We have IOC's investing billions of dollars and they're willing to work together on the research agenda in Qatar; so I think it is doable.

**DR. EYAD MASAD** I think we're all saying that we have the leadership vision and commitment from IOC's and NOC's to continue to make R&D in Qatar a success. We are making a lot of progress but there's homework to do. We need regulations and policies in place in order to ensure we head in the right direction and that there is alignment. ■

WHITE PAPER:  
Delivering Energy Security  
Through Energy Efficiency

**Gulf Intelligence**



## INTRODUCTION

With global energy demand set to roughly double by 2050 versus today's levels, ensuring uninterrupted energy supplies at affordable prices has become a top priority for most countries.

Whether in Asia, Europe or in the hydrocarbon-rich Gulf region, which is emerging as a major energy consumer in its own right, energy security has never been more important to ensure economic development, economic stability and economic security. Improving energy efficiency—in other words using less energy to provide the same level of energy service—is integral to managing and restraining growth in energy consumption, and thus a powerful tool to ensure and sustain energy security.

Moreover, enhanced efficiency doesn't just save raw materials and energy; it also offers an alternative to new power generation investments and reduces emissions, in turn helping address critical topics such as global warming and climate change. It is of particular importance at a time when the production of energy is becoming increasingly intertwined with that of water and agriculture, putting all these vital resources under greater pressure as demand for all of them continues to rise on the back of rapid world population growth.

## QATAR

It is in this context that Qatar in November identified energy and water security as two of the grand challenges to be addressed through research and development (R&D) in coming years. Being one of the world's top energy consumers on a per capita basis, partly because of the Gulf state's heavy reliance on seawater desalination due to a lack of large freshwater resources, achieving greater energy efficiencies will be integral to developing a

sustainable economy over the mid to long term.

Encouraging innovation and competition through R&D will play a seminal role in the development of more energy-efficient solutions for new and existing infrastructure such as power and industrial plants, buildings and transportation. Research into energy-efficient smart electricity grids, more efficient desalination and low-carbon technologies such as CO<sub>2</sub> enhanced oil recovery (EOR)—which is already under way in other parts of the world—could go a long way in helping address efficiency issues, both in Qatar and elsewhere, and as a result deliver greater energy security and better resources management.

Initial steps are also under way in the Gulf state towards managing existing facilities in a more efficient manner and raise the general level of awareness on the issue. Under Qatar's Vision 2030 and the Qatar National Development Strategy 2011-2016, for example, the country aims to reduce the energy intensity of electricity consumption through awareness campaigns, standardization and seasonal shutdowns, which will generate noticeable energy savings.

Boosting efficiencies also extends into other areas of Qatar's energy value chain. The country holds major hydrocarbon resources, including the world's third-largest gas reserves after Russia and Iran. Ensuring that these resources are recovered and produced in the most efficient and sustainable manner is crucial for the longevity of Qatar's hydrocarbon sector and – given its size and importance – the overall economy.

The moratorium on the North Field, whose development has made Qatar's rise to the top of the world's liquefied natural gas (LNG) exporting nations possible, highlights the importance of extracting national hydrocarbon resources as efficiently as possible to sustain their availability and value in the long term.

## TECHNOLOGIES

Wherever efficiencies are being targeted, they won't be achieved without the application of innovative technologies and the development of new ones. The benefits are potentially enormous.

“The potential for advances in technology to increase recovery efficiency, even in small increments, will have huge impacts on the ultimate value extracted from Qatar's natural resources,” Hamad Rashid Al Mohammadi, CEO of RasGas, said at the The Gulf Intelligence Energy R&D Forum in Doha.

Technology advances in the oil and gas industry have been rapid in recent decades and triggered a period of transformational change throughout the industry.

Innovations, often bolstered by information technologies finding their way into the energy sector, have altered the way oil companies operate across all verticals, from identifying reserves to exploring and developing them to production. Investments in R&D and new technologies have been behind the breakthrough in shale oil and gas developments in North America, which only 10 years ago weren't on anyone's radar.

In a survey conducted at The Gulf Intelligence Energy R&D Forum among nearly 150 leaders from academia, government and industry, more than three quarters of all respondents expressed the view that similar technological advances will drive another period of transformation in the next 10 years, as the world seeks to find solutions to the nexus of water, energy and food, of which energy efficiency will be a key element.

For Qatar, investing in R&D into energy-efficient technologies and solutions is particularly important at a time when domestic electricity consumption continues to grow at a rate of about 7 percent annually, driven by rapid population growth and expanding industries, putting increased strains on existing natural gas resources to provide feedstock for the country's growing number of gas-fired power plants.

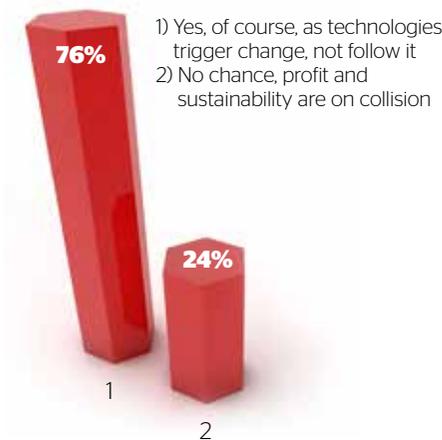
“The only way to face this challenge is that we need to focus on the best possible means to improve utilization of power plants, good cost control, power plant efficiency and power generation through other means such as renewables.”

Fahad Hamad Al-Mohannadi, General Manager of Qatar Electricity and Water Company (QEWC), said at the forum. “Power stations should be run on maximum efficiency and old plants should be replaced with higher-efficiency plants.”

While Qatar, unlike its Arab Gulf neighbors, doesn't face a gas shortage, freeing up the resource from being burned in power stations by increasing their efficiency and introducing more alternative energies, and thus saving gas for future use or diverting it into the development of new petrochemical production, for example, would add more value to the national economy.

The need for greater efficiency is also obvious in the water sector, where according to expert estimates, losses of desalinated water – produced with energy generated at

**QUESTION 1** Thanks to R&D, the past 10 years have seen advances in technology that have triggered a transformation of the global oil industry. Will the next 10 years bring about a similar step change enabling a balance.



gas-fired power plants – through distribution and delivery, range between 10 and 40 percent across the Gulf region.

Another example for the need to introduce greater efficiencies is the transportation sector. Transport currently accounts for more than half of the world's oil consumption and 28 percent of global energy use, of which around 40 percent is used in urban transport alone. Improving the energy efficiency of urban transport systems globally could save as much as \$70 trillion in spending on vehicles, fuel and transport infrastructure by 2050.

Qatar is addressing the issue with the construction of a tram system being built in Doha by Siemens that will consume up to 30 percent less energy per year than conventional tram systems. Utilizing a technology called Sitras hybrid energy storage (HES), the trams will also produce less CO<sub>2</sub> than vehicles without the HES systems, thus contributing to energy conservation and climate protection.

“When talking about maximizing resources, there needs to be fundamental research aimed around how you expand the resource base and make more forms of energy available,” said one industry executive at the forum.

“That can be hydrocarbon resources; that can be solar; it could be anything. It's just about expanding that resource base because the energy demand of the future is going up. And it's significant because it ties to population growth and economic growth and all those factors. So one needs to look into the value

“Energy security has never been more important to ensure economic development, economic stability and economic security.”

“Over the past five years, Qatar has taken concrete steps to build up its domestic R&D capabilities and capacities.”

chain. There's the diversification of the resource base and expanding supplies. But then there's also the kind, which is the energy intensity and efficiency. That's the other end of the value chain. You need to have dedicated streams of research there.”

R&D and technological innovation will be integral to driving industry efficiencies going forward. But other, complimentary measures will need to be implemented by GCC governments to ensure they do indeed have the full desired impact, notably an upward review of domestic energy and water pricing.

While reducing subsidies—or even thinking it out aloud—remains politically sensitive, it is an issue that will need tackling in one way or another in the not-too-distant future in the GCC, since the region's low energy and electricity prices, which are well below international benchmarks, have been the main contributors to strong energy demand growth and encouraged investments into inefficient infrastructure across all economic sectors.

“Energy saving is a challenge for the Gulf countries, and people and rules should be carefully reviewed to ensure that these future challenges are being managed in a way that the consequences on the economy are minimized,” said Fahad Hamad Al-Mohannadi of QEWC. “Privatization is one of the mechanisms that can be considered to own and operate power plants, and we should concentrate our efforts on research to reduce fuel consumption for every MW generated and every cubic meter of water produced.”

With this in mind, achieving greater energy efficiency across the economy in Qatar, as in other Gulf states, will require the introduction of a comprehensive regulatory framework centered around a sustainable long-term policy that also addresses energy—and water—pricing. This will also have to include the provision of

incentives and obligations to adapt energy-efficient solutions and technologies, which in turn will have to be monitored and enforced.

National and international energy companies, including international oil companies (IOCs), have an important role to play in addressing the overall efficiency challenge by driving R&D, innovation, and the development of advanced technologies.

At the Qatar Science and Technology Park (QSTP) in Doha, Chevron Corporation opened its Center for Sustainable Energy Efficiency (CSEE) in 2011, while Shell last year teamed up with QSTP, Qatar Petroleum and London's Imperial College to carry out research into carbon capture and storage (CCS) from a new lab at QSTP. Other companies are pursuing similar projects aimed at supporting the Gulf state's strategy for sustainable development.

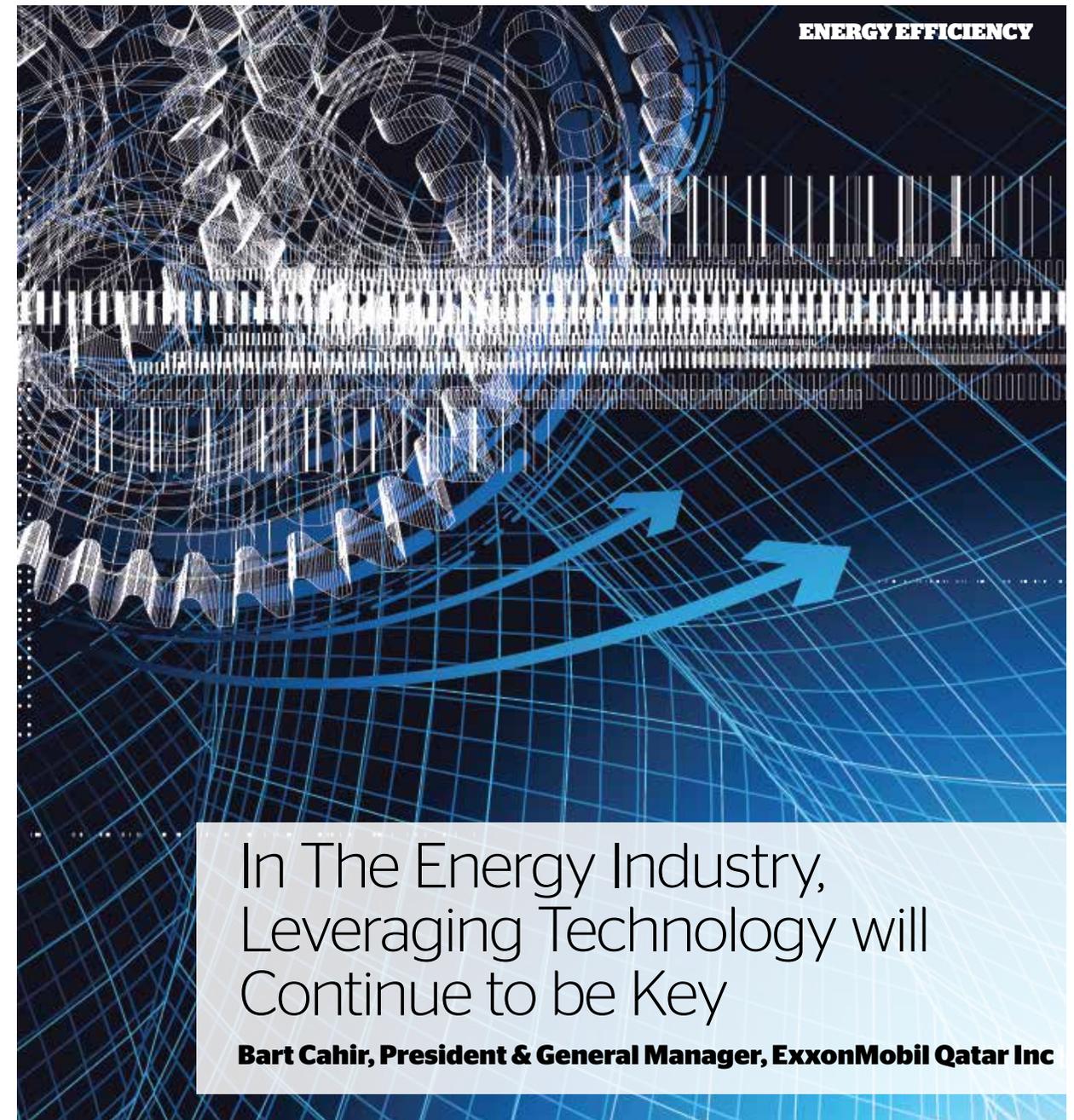
#### GOVERNMENT

While companies pursue R&D and innovations, governments hold the key to creating environments in which R&D can thrive and have recognized the key role that R&D plays in addressing the energy and socio-economic challenges in the region. Supporting relevant R&D as part of a national energy policy that at the same time ensures the environmentally-responsible and economically-efficient development of its resources to maximize long-term benefits, is therefore in the interest of any government.

Over the past five years, Qatar has taken concrete steps to build up its domestic R&D capabilities and capacities, and at the same time implemented initiatives to enhance and expand capacity in its education system in order to build a society that embraces science and the advancement of technology. The announcement of the three grand research challenges in November has been an important step in that direction.

As the country's R&D ambitions take shape, Qatar will, however, have to put even greater emphasis on creating a broader environment conducive to innovation, entrepreneurship and collaboration among the three key stakeholders tasked with realizing its vision—industry, government and academia.

Going forward, national and international stakeholders will have to align on identifying the sectors and industries with the biggest energy-efficiency potential within Qatar's existing economic setup and take guidance from this on what areas stakeholders focus their R&D activities on. ■



In The Energy Industry,  
Leveraging Technology will  
Continue to be Key

**Bart Cahir, President & General Manager, ExxonMobil Qatar Inc**

**ANY DISCUSSION** of research and development (R&D) in the energy sector must acknowledge the important role technology plays. The energy industry has long leveraged technological outputs from R&D to pioneer safe development. Over the last 25 years, for example, the industry has moved into the deep water and now into ultra-deep water to develop oil and gas resources.

In Qatar, evolving technologies have helped unlock the North Field over the last 25 years and develop its resources to raise liquefied

natural gas (LNG) production to 77 million tons annually, making it the largest producer in the world. More recently, the industry has seen the surge of unconventional gas resources, particularly in North America – a development that's now beginning to spread to other parts of the world. It is a long-standing tradition in the industry of taking research and development and putting them to use.

With global energy demand expected to increase by about 35 percent by 2040 as compared to 2010, our approach to meeting

“With global energy demand expected to increase by about 35 percent by 2040 as compared to 2010, our approach to meeting the energy challenges of the next 30 years must pursue the right research and technological advancements at every link in the energy value chain and in every sector of society.”

the energy challenges of the next 30 years must pursue the right research and technological advancements at every link in the energy value chain and in every sector of society. This can only happen when governments, industry and academia work together. With the right policies creating free and fair markets, the private sector can and will invest in tomorrow’s visionaries, scientists and engineers. As an industry, we have to do this with the right spirit of collaboration and the right aims.

In this regard, Qatar remains a prime example of R&D, innovation and collaboration in action. Innovation is cherished and encouraged as an indispensable value. ExxonMobil has been able to fully participate in Qatar’s collaborative ecosystem as we progress research with the help of many of our stakeholders. With our joint ventures we are progressing technologies from our research facility here at the Qatar Science and Technology Park (QSTP) to autonomously scan for hydrocarbon leaks. This research is both a net positive from a safety perspective, but also potentially from an environmental perspective in terms of reducing emissions into the atmosphere.

In addition, we are conducting extensive environmental management research with Qatar University’s Environmental Studies Center on research into water reuse and pursuing other research programs in collaboration with stakeholders, including the Ministry of Environment and the Ministry of Municipality and Urban Planning. We have also announced a research stream with Qatar University and the Ministry of Interior. Engaging with such a broad collection of stakeholders is one of the key success factors here.

The hope is that all these forms of R&D will develop the right kind of thinking

in technologies that can be included in policy decisions, can develop commercial technologies and, ultimately, get us into a place where the industry continues to extend the ecosystem that has been so successful in the past. Additionally, the Qatar National Research Strategy reflects the extensive input from Qatar’s research leadership, researchers and various stakeholders, demonstrating the country’s deeply-held commitment to the values of innovation and collaboration.

Qatar Foundation has led this initiative and—recognizing the role technology advancements play in a country’s development—its approach used is indicative of the collaborative thinking here. It has reached out to a broad set of stakeholders and defined three important grand challenges around cyber, energy and water security, which in many ways are grand challenges here in Qatar but also very pertinent to our industry and our individual research objectives. Arguably, they are also grand challenges for humanity. It is a noble effort and provides industry with a roadmap on where to aim its efforts.

As members of the energy industry, we have a responsibility to work together to continually spur further advancements and breakthroughs in technology that help us do our jobs in a way that maximizes the value and efficient use of resources, while increasing safety, improving human health and protecting the environment. One of our underlying safety foundations at ExxonMobil is that we have to “protect tomorrow, today.”

The collaboration between industry, government and academia has been successful in the past and in the future will reap maximum rewards, not only for our own industry, but for society and humanity at large. ■



**Bart Cahir, President & General Manager, ExxonMobil Qatar Inc**



## R&D in Qatar – Thriving on Collaboration

**Dr. Hassan Al Derham, Vice President for Research, Qatar University**



**QATAR UNIVERSITY**, together with its partners, is committed to enabling Qatar's scientists compete on the global stage. It is therefore incumbent on us not only to address the financial resources and the scientific tools but the entire research ecosystem.

As a national university focused on our basic local challenges with global dimensions, Qatar University is built on providing solutions that will accelerate the achievement of the objectives of the Qatar National Vision 2030. Together with Qatar Foundation Research & Development (R&D), Qatar University is involved in the effort of developing the Qatar National Research Strategy (QNRS) and is working closely with its partners and major stakeholders in addressing the country's research grand challenges.

Internally, in the last two years, we have been targeting research purposes that are in alignment with the QNRS and the national research grand challenges. Currently, we have working groups and committees developing our roadmaps to build research clusters, programs and infrastructure to raise

awareness regionally and globally, including about the identified research priorities. It has become imperative to map out a clear and specific set of research priorities that reflect the unique responsibility, commitment and position of the university to support research that is aligned to the national priority needs.

Our research priorities are made based on the need to align with major national needs as outlined in the Qatar National Vision 2030, Qatar National Development Strategy 2011-2016 and QNRS. Building on current Qatar University research streams and capabilities in interdisciplinary research areas, we are responding to regional and international challenges that are relevant to Qatar and creating areas of excellence for Qatar University.

One of the research grand challenges identified for Qatar is energy security. The issue is as important to Qatar University as it is to the country as a whole. Our research work does not downplay the fact that Qatar is one of the leading exporters of energy resources in the world, and we are observing

and paying attention to issues like climate change and renewable energy resources.

To this end, our researchers and students are working on evolving a sustainable process for carbon dioxide sequestration, for example. Other areas of interest for us in respect to energy security are low-carbon technologies, renewable energy, fuel cells and energy planning and policy, because advances in R&D have to be made for Qatar to achieve sustainable energy security. It is Qatar University's role to explore options that will make this possible.

The importance of energy security comes from the critical role that energy plays in all aspects of our lives and it is an important research program in Qatar University. The research addresses three priority challenges within the energy security theme: solar energy, energy storage and smart-grid integration. Our current research activities include solar energy to fuel, solar photovoltaic for desalination and irrigation, and bio fuel from organic wastes.

In the area of bio fuel and the search for

“ For Qatar, energy security may not just be about reliable, stable and sustainable supply of energy at affordable prices but also about meeting rapidly-rising domestic needs and being able to meet export requirements. For our research efforts, in this regard, to be fruitful and sustainable, there has to be extensive collaboration with the industry.”

diversified renewable and environmentally-friendly energy from natural resources, Qatar University has established state-of-the-art laboratory facilities for microalgae run by a world-class team. The team has succeeded in identifying and isolating local microalgae strains from Qatar's environment. The project, backed by Qatar Science and Technology Park (QSTP) and Qatar Airways, is one of the most important projects being undertaken by Qatar University that will save the country significantly in various fields, even in fuel security in the future.

For Qatar, energy security may not just be about reliable, stable and sustainable supply of energy at affordable prices but also about meeting rapidly-rising domestic needs and being able to meet export requirements. For our research efforts, in this regard, to be fruitful and sustainable, there has to be extensive collaboration with the industry.

Already, the relationships with our industry partners are bearing great fruits. However, all stakeholders in the energy sector in Qatar have to work together towards meeting this grand challenge. The type of gathering that we're at today will go a long way synergizing our efforts towards achieving the national goals of research and development in Qatar. Generating alignment with industry therefore is a step in the right direction towards achieving greater domestic research capacity and capabilities. ■



*Dr. Hassan Al Derham,  
Vice President for  
Research, Qatar  
University*



## Shale Gas – The Real Game Changer?

**James McCallum, CEO & Chairman, LR Senergy Group**

**WHEN NATURAL GAS** prices in the U.S. soared in January on the back of another cold snap in a long and weary winter, it wasn't simply due to an imbalance in supply and demand.

Sure, gas consumption had been climbing in light of the freezing arctic air hitting large parts of the U.S., including as far south as Louisiana and Texas. But with the U.S., holder of some of the world's largest unconventional gas deposits, having emerged as a major producer of shale gas over the past five years—shale production accounted for almost half of domestic gas output in 2013—the problem wasn't a lack of supplies. The real issue was that much of the gas wasn't available where it was needed most.

The gas price spike in New York on Jan. 22 was a case in point. That day, prices for next-day delivery in and around New York City soared to a stunning \$120 per million British thermal units (BTU) – roughly 20 times higher than the price at the time in southern U.S. states where fewer bottlenecks exist in the regional gas distribution infrastructure such as pipeline systems and storage facilities.

In the northeast, however, the situation is different. The region is more densely populated and, at the same time, facing supply constraints because of the distribution and storage system's limited capacity, which prevents it from delivering enough gas to the main consumption centers such as New

York during seasonal demand spikes. Despite unprecedented gas production levels from shale reserves, the resource simply can't be made available all over the country all the time.

To be sure, shale gas developments in the U.S. have revolutionized the local energy sector in a way that few would have expected only five years ago. But with U.S. gas demand set for further growth in coming years on the back of higher usage in transport and industries, more pipeline exports to Mexico, and planned liquefied natural gas (LNG) shipments to Asia and Europe, the infrastructure bottlenecks need to be resolved urgently if the country as a whole is set to reap the benefits of the shale boom in the form of cheap and widely available gas.

The situation in the U.S. goes to show that the development of shale reserves can potentially be a game changer – but it won't happen easily and certainly not overnight.

Among the greatest challenges for the global gas industry has always been putting in place the infrastructure to deliver the fuel from its source to the main consumption centers, in particular covering long distances cross-country. The situation is even more complex when extracting shale gas because it requires extensive midstream pipeline networks to gather the gas recovered. That's before the gas enters the downstream systems for transportation and distribution.

In the U.S., with its 305,000 miles of inter- and intrastate transmission pipelines, the distribution network is among the world's most advanced. This existing infrastructure, and open access to it, has been a key facilitator in the growth of the domestic shale gas industry. Yet, it is in urgent need of expansion to prevent bottlenecks mid- and downstream.

The Interstate Natural Gas Association of America (INGAA) estimated in 2012 that the U.S. will need to add gas transmission pipeline capacity to the tune of 43 billion cubic feet per day and 414,000 miles of new gas-gathering lines over the next 25 years to handle rising production.

In China, a shale gas hopeful, infrastructure is an even bigger challenge. The country may sit on the world's largest potentially recoverable shale gas reserves at an estimated 1,115 trillion cubic feet (tcf) according to the U.S. Energy Information Administration, compared with 665 tcf in the U.S. But the total length of its gas pipeline network is just around 32,000 miles.

Building out the mid- and downstream pipeline systems and related infrastructure to

“The role of technology and innovation doesn't end with the inauguration of projects. The potential for advances in technology to increase recovery efficiency, even in small increments, will have huge impacts on the ultimate value extracted from Qatar's natural resources.”

accommodate the gathering and distribution of shale gas will be an enormous and costly task. To address this, independent producers will need to be given pipeline access at a fair price as an incentive to enter the unconventional market. At present, China's pipeline network is controlled by three state-run companies.

There are other challenges to the development of shale gas. In China and Saudi Arabia, another potential shale gas heavyweight with more than 600 tcf of estimated recoverable reserves, the bulk of the resources are located in semi-arid or arid regions. Since the production of shale gas via hydraulic fracturing requires vast amounts of water, this could present an obstacle to recovering these reserves – at least until water-free fracking becomes commercially feasible. This is still some way off, however.

Add to this the need for advanced technology, skilled personnel, and sound regulatory frameworks covering land rights and pricing, and it becomes clear why many shale gas plays may still be years, or even decades, away from materializing. After all, it took the U.S. some 20 years to bring shale gas within the realm of technical and economic feasibility.

So is shale gas truly a game changer? It has, without a doubt, added a new dimension to the U.S. energy industry and the economy at large. Lower gas prices translate into cheaper electricity production and industries such as petrochemicals are getting an unexpected shot in the arm. There are other benefits. But unless the structural challenges will be overcome, shale gas will predominantly play out on a regional level. The times of winter gas price spikes aren't over just yet. ■



**James McCallum, CEO  
& Chairman, LR  
Senergy Group**



WHITE PAPER:  
Collaboration Opportunities,  
Collaboration Obstacles

**Gulf Intelligence**

**OVERVIEW**

Qatar’s release of three priority areas for domestic energy research and development (R&D) activities is widely seen as an important milestone on the path towards establishing itself as a global energy R&D hub in coming years.

But while the announcement of the three grand challenges of energy security, water security and cyber security has provided some focus and guidance to local R&D stakeholders on what to prioritize, further clarifications are needed and obstacles that stand in the way of greater collaboration in research activities will have to be addressed to ensure that Qatar’s R&D ambitions will indeed be realized.

In a survey conducted at The Gulf Intelligence Energy R&D Forum in Doha among nearly 150 leaders from academia, government and industry, almost two thirds of all respondents expressed the view that Qatar Foundation’s release of the prioritized grand challenges in November had not or only partly provided them with the clarity they had hoped for in terms of the future direction of energy R&D in the country .

To this end, stakeholders have begun seeking further guidance on the scope and definitions of the grand challenges, and energy security in particular, to ensure that their R&D activities and mandates will be aligned with Qatar Foundation’s priorities and produce locally relevant results. It is broadly acknowledged, however, that this clarification process will take time – just as the nature of R&D is a long-term undertaking.

“I think there is a learning curve that we have to go through. Let’s not forget that the announcement of this ‘grand challenge’ only happened four to five months ago, and forums like this will help clarify things for all of us, all stakeholders,” Dr. Hassan Al Derham, VP for Research at Qatar University (QU), said at the forum.

**QUESTION 1** Qatar Foundation in November announced the three grand challenges that their R&D priorities would be focused on energy security, water security and cyber security. Has this provided the sense of clarity on the direction that energy R&D stakeholders in Qatar were looking for?

- 1) Yes
- 2) No
- 3) Questions Remain



According to Dr. Andrew Wigton, Research Director at the ExxonMobil Research Center, Qatar Foundation’s move towards a priority scheme is a positive development as it gives stakeholders a better understanding of where the potential research opportunities will be going forward.

“I see the initial three grand challenges as a focusing mechanism. The National Research Strategy is a bit broader and I think the people at Sidra Hospital would hope that it’s broader than just what we’re talking about here today. It’s an identification process; there’s a whole wide range of things to be working on and having a structured way of getting to where you need to be to start, is very valuable, and it’s valuable to us to understand that,” he said.

**COLLABORATION**

As Qatar’s R&D strategy continues to shape up, national and international energy companies on the ground will seek out new research areas or focus on moving forward with existing ones to address in line with the Gulf state’s requirements and their respective internal research strategies and targets.

“If you look at the research field, there are many players – IOCs, NOCs, researchers

in universities; each one has a different business model and different mandates,” said one Qatari industry executive at the forum. “To bring them all together will be difficult and challenging. However, I think where it will bring them together is when there’s a common interest between all these players. So, for example, if we find a challenge, in my case our department says: ‘We need skills from outside and we need it urgent’. Then we can create a JIP, for example, a joint industry project, where we call out for a proposal for all the centers, all the players in the research field to give us solutions.”

With mandates of key stakeholders becoming clearer as Qatar’s research strategy is being fine tuned, energy companies will now have to identify common ground between their R&D activities and those of their peers in the sector to drive cross-industry collaboration, while at the same time identifying any obstacles standing in the way of closer collaboration and alignment with other companies as well as universities. National institutions such as Qatar Foundation are well positioned to take on bridging and coordinating roles between industry stakeholders specifically if and when needed – for example with regard to data sharing.

While sharing of even vast amounts of data is no longer an obstacle from a technology point of view, thanks to today’s advanced IT infrastructure, and data sharing is generally

seen to enhance research and scientific knowledge, it may be an issue from a legal point of view. This is certainly the case when it comes to the sharing of sensitive data relating to state-owned hydrocarbon reserves for example. As such, the degree of research collaboration will always vary from firm to firm and project to project as sharing may be restricted contractually due to proprietary and confidentiality clauses.

“In some areas, we cannot share data outside the company. That makes it a bit difficult,” the Qatari industry executive said. But “data cannot stop the researchers to work on [projects]. I think the challenges are already obvious, and people can work on a field without data if they want to work on fundamental research.”

Despite challenges related to data sharing, aligning strategies to mandates across the key energy industry stakeholders will be essential to ensure that R&D can have tangible impact on Qatar and lead to secure field trials and eventual commerciality – an important requirement for companies.

The industry is already carrying out research into areas of relevance to Qatar such as water sustainability, desalination, solar and synthetic aviation fuel, and over the last 12 months, the major national and international players in Qatar’s energy sector have made some leaps forward to advance their R&D programs.

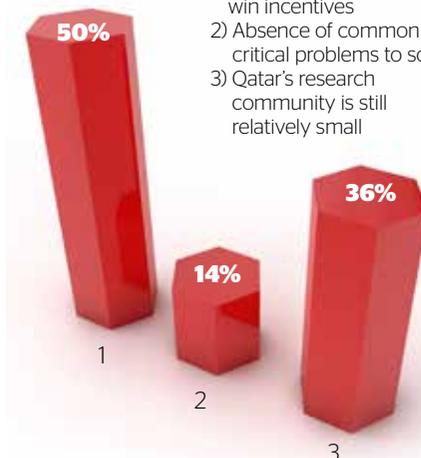
Qatar Petroleum opened a dedicated Research and Technology Center at the Qatar Science and Technology Park (QSTP); Maersk Oil launched its digital core laboratory that will support ongoing applied research efforts in the area of enhanced oil recovery (EOR); ExxonMobil scientists continued to investigate water treatment technologies; and Qatar Shell opened a water lab. At the same time, QU launched new research divisions, while the Annual Research Conference held its 2013 edition in November.

However, to align national and international energy R&D stakeholders’ mandates successfully in the long term, more dedicated platforms will need to be created that help identify the areas where collaboration for joint industry projects is most feasible and promising in terms of producing locally-relevant results.

According to The Gulf Intelligence Energy R&D Forum survey, 50 percent of respondents thought that greater collaboration in the wider R&D space is still being held back by the absence of obvious win-win incentives . Of the remaining survey

**QUESTION 2** It’s much easier to talk about the need for collaboration than to implement it – which of the following is the greatest obstacle that continues to hold it back?

- 1) Absence of obvious win-win incentives
- 2) Absence of common critical problems to solve
- 3) Qatar’s research community is still relatively small



“ New innovation ecosystems will emerge organically as various players share a common vision and realize the advantages of collaboration.”

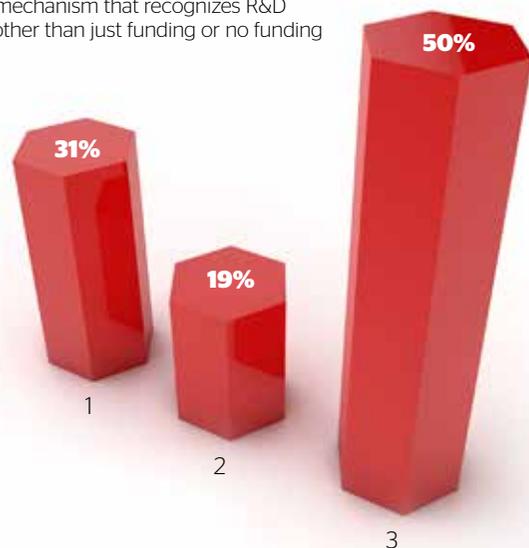
Washington Economic Development Commission Strategy

participants, 36 percent expressed the view that collaboration was lacking due to the relatively small size of Qatar’s research community, while 14 percent believed the absence of common critical problems was to blame.

While the introduction of clear win-win incentives for collaborative research activities would be important, it will be

**QUESTION 3** For hydrocarbon energy industry R&D players that don’t seek research funds from The Qatar National Research Fund and/or that pursue R&D considered outside the defined areas of the 3 Grand Challenges. Should Qatar create a ratings system that ranks this R&D according to its impact in addressing national needs, similar to how a ratings agency rate countries or companies?

- 1) Yes
- 2) No
- 3) It would be worth considering some sort of official mechanism that recognizes R&D activities other than just funding or no funding



equally important for the government to provide clear regulations and frameworks covering intellectual property rights and the commercialization of research, among others, as part of the creation of an entire ecosystem conducive to R&D.

At the same time, energy companies involved in R&D in Qatar will continue to seek guidance on the type of research that falls within the government’s set of priorities and align their specific research strategies with the relevant national stakeholders in industry and academia, including Qatar Petroleum, Qatar Energy and Environment Research Institute and QU’s new research divisions.

Some of this guidance could be provided via some type of ratings system that would rank R&D in Qatar according to its impact. This would provide a measure for research that doesn’t fall under the grand challenges umbrella or for research projects that don’t seek to tap any local research funds.

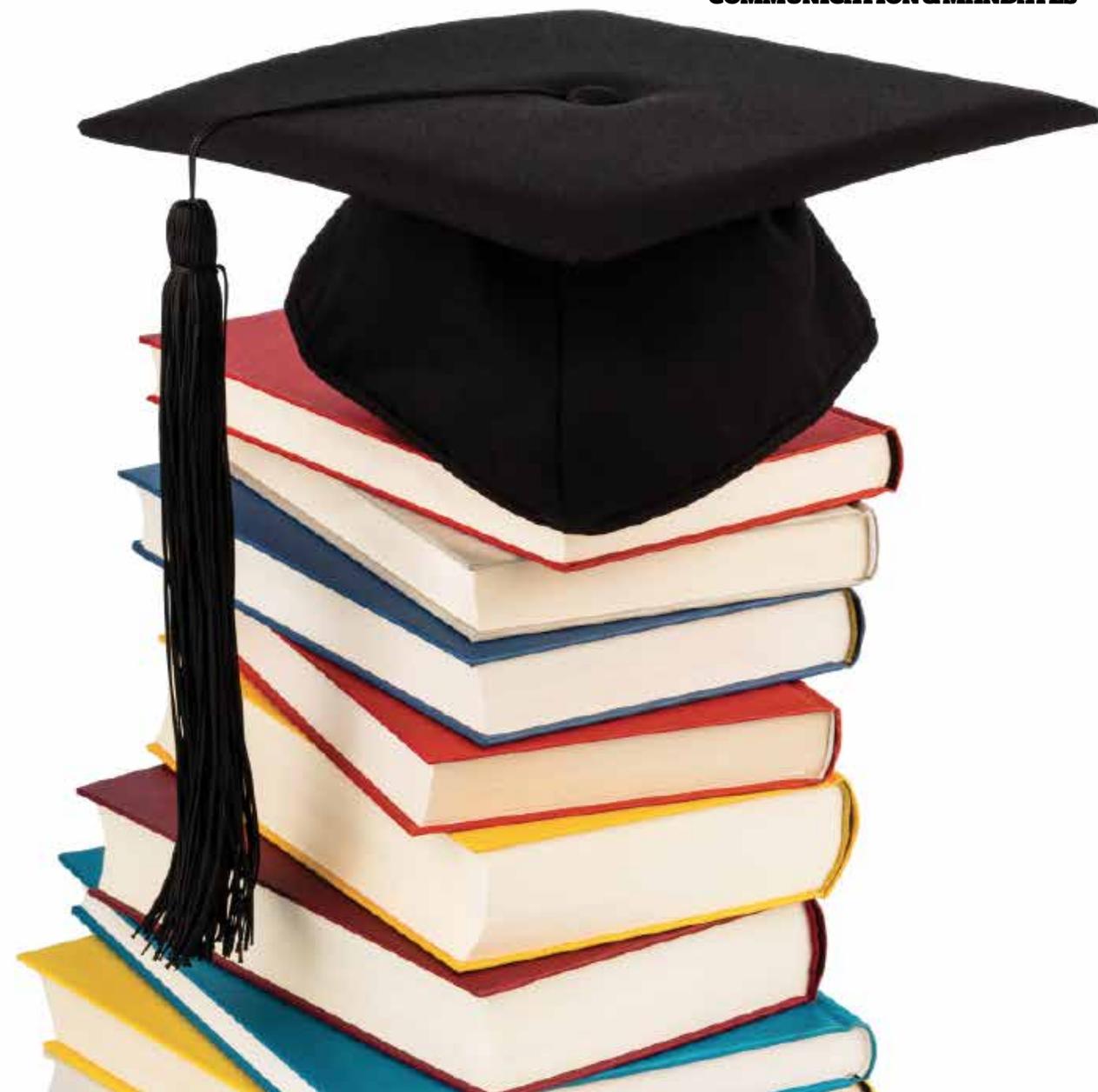
As many as 31 percent of the survey respondents at the Doha forum agreed that the introduction of this type of ratings system would be desirable, while 50 percent of those surveyed said it would be worth considering some sort of official mechanism that recognizes R&D activities other than just through funding or no funding . Only 19 percent rejected the idea.

“One challenge now is to ensure that we continue to engage and focus on building capability, and not run too fast, continue with the process of engagement with stakeholders, and to highlight how we can partner and work well together,” said Dr. Thomas Zacharia, Executive VP of R&D at Qatar Foundation. ■

## Strategies for Academia-Industry-Government Collaboration

- Strengthen the dialogue and collaboration between national and regional innovation stakeholders and create new platforms for communication
- Build trust and collaboration by promoting joint projects with clear objectives and benefits for all stakeholders
- Make ‘smart investments’ for consolidating specific competitive advantages of the region and improve inter-regional alliances/ consortia for achieving critical mass
- Promote collaborative governance measures, such as public consultation and feedback, and collaborative leadership models and practices
- Ensure government financial commitment for successful projects beyond the 4-5 year policy cycle
- Ensure adequate communication of innovation achievements to society

Source: ‘Building University-Industry-Government Alliances for Innovative Regional Ecosystems: Research and Policy Trends’. See <https://www.dnp.gov.co/LinkClick.aspx?fileticket=-Ra4IL-YYUE%3D&tabid=1433>



# Building Unique Competence, Building Practical Partnerships

**Dr. Nasser Al-Mohannadi, Research and Technology Manager, Qatar Petroleum Research & Technology Centre**



### THE FOCUS OF THE QATAR PETROLEUM

research center at Qatar Science and Technology Park is to support the company's existing business, to improve operations and existing technologies, and to drive new business opportunities.

With its two Research and Technology divisions, the research centre focuses on subsurface theme areas on the one hand and on operations theme areas on the other. These themes areas, which also take into consideration important environmental issues, were chosen as a result of close engagement

with our internal stakeholders over the past year and a half.

On the subsurface area side, we have several themes that we want to focus on. Some look at exploration; others are related to reservoir management, which touches on rock and fluid characterizations, infectivity and productivity, reservoir simulation, and enhanced oil recovery methods. On the operations side, the focus is on drilling-related issues. In terms of production, we are looking for process optimization in areas such as gas processing and material corrosion, while in

terms of environmental issues, the focus is on energy management, water management, energy efficiency and CO2 capturing and storing.

The various R&D stakeholders in Qatar have different mandates. When it comes to International Energy Companies, they seek growth and competitive advantages, while service companies focus on products and commercialization. Research institutes like Qatar Foundation on the other hand enable conducting and facilitate carrying out research activities. As for universities, their focus is on publication, education and producing graduates. When it comes to government, it's about regulations and policies.

Going forward, with Qatar's R&D ambitions in mind, all these players will need to be brought together. The key question is: can we do more than just sitting together in a room discussing or sharing ideas? That's difficult to answer because each player has different mandates or objectives.

So how can industry and academia pursue collaboration? The classical example is the Joint Industry Project (JIP), where industry comes up with a problem and goes to the universities to solve it. Another option may be for industry to launch a tender or call for proposals.

If we want to do long term R&D and start with a fundamental idea, if that's the challenge, then the solution is to enter into long-term agreements with universities. That's where we start doing fundamental work. However, if we want to do a prototype then we may go a step further by entering into collaboration with research institutes. If one then takes another step to carry out field testing, then we go with IOCs and NOCs. The next step beyond this of course is products and producing these products, for which we would seek to collaborate with service companies.

It is therefore clear that in each of these steps, the players are different and in each step, people's skills and Intellectual Property (IP) requirements are different, so different contract models will be required. Of course, it is essential to have a clear understanding of each other's objectives, interests, and business models.

We have various examples that can help in terms of setting up the infrastructure. One is tax incentives. If you look at Europe, the UK and Norway for example offer reductions in taxes on the returns generated from their oil and gas operations if they prove that they do real research. Another example is the

“Going forward, with Qatar's R&D ambitions in mind, all these players will need to be brought together. The key question is: can we do more than just sitting together in a room discussing or sharing ideas?”

government of Brazil, which takes 2% of the income generated from companies carrying out hydrocarbon activities on the pre-salt basin and then offers these companies 1% if they pursue real research. As a result, Schlumberger, BG Group and Baker Hughes have set up research centers in Brazil. Petrobras has an R&D Centre with more than 3,000 researchers. Another example is ANR in France, the National Research Agency, which makes available state funds for the public and private sector research community.

An important question is, of course, how to develop people's skills for the R&D sector? When it comes to skills, it is important to have in place two things: one is conducting or creating research activities that are of real-life relevance and at the same relevant to businesses; and second, to provide talent with research careers and growth opportunities in the research domain. This is essential to attract more people into research.

Another point, which is very important, is that if one looks at researchers' backgrounds, many of them are scientists coming from geology, chemistry, physics or mathematics. It is therefore important to create a market for these science disciplines and not to focus just on engineers.

There is one final point: it is essential to instil interest in science among the young generation. It would therefore be desirable to create a Science Park in Qatar that people can go to with their kids to learn, for example, about oil and gas activities, how oil and gas are being produced, different technologies in operation in the industry, and what study disciplines will be needed in the future. This would be an important initiative to support Qatar's future R&D ambitions. ■



**Dr. Nasser Al-Mohannadi,**  
Research and  
Technology Manager,  
Qatar Petroleum  
Research & Technology  
Centre

The background features a world map in shades of blue. Overlaid on the map are several rounded square icons, each containing a map of a different region. A hand from the bottom left is pointing upwards at a glowing globe icon. The word "innovation" is written in large, white, lowercase letters across the center of the map. Binary code (0s and 1s) is scattered throughout the background.

# innovation

Building Competitive Economies Through Innovation and R&D

**Youssif Saleh, General Manager, Qatar Shell Research & Technology Centre**



**IT IS WIDELY RECOGNIZED** that, in the 21st century, a modern economy's competitiveness is largely defined by its ability to develop, apply and commercialize knowledge. With this in mind, a growing number of countries are accepting the notion that promoting and investing into innovation have to be integral parts of their economic policies.

Qatar is a case in point. When the country announced in 2006 that it would commit 2.8 percent of gross domestic product (GDP) annually to research and development (R&D), it put the Gulf state firmly on track to meeting its national objective of transiting into a knowledge-based economy and reducing its dependence on the hydrocarbons sector to prepare Qatar for 21st century challenges as part of its National Vision 2030. The country has since made considerable progress on creating an environment conducive to world-scale research and

innovation, and enhancing its education system across all levels.

The establishment of the Qatar Science and Technology Park (QSTP) five years ago has been of particular importance for Qatar's long-term R&D ambitions. While the complex provides the essential physical infrastructure needed to conduct successful research, it has also managed to bring together leading international oil companies (IOCs)—Shell included—as well as other energy companies under one roof, thus establishing QSTP as the leading 'research accelerator' in the region.

For all parties involved in R&D in Qatar, the availability of this vast industry knowledge and expertise, combined with the presence of branches of some of the world's best-known universities in Doha as well as dedicated government organizations, provides a unique opportunity for collaboration and innovation to tackle some of the Gulf state's—and indeed

the world's—most pressing challenges related to energy and water.

But although the opportunity for comprehensive cooperation between academia, industry and government exists, and communication channels that previously weren't available have opened up, the true potential for collaboration hasn't been tapped. As Qatar's R&D strategy has gathered further momentum over the past 12 months, however, this is expected to change.

In November, Qatar Foundation announced three priority research areas under the Qatar National Research Strategy (QNRS), which now provides a clear focus on energy, water and cyber security. The prioritization has opened up the opportunity to work towards and achieve greater alignment between energy industry stakeholders and national research objectives.

This will be essential to ensure that R&D activities will have a tangible impact on Qatar and lead to secure field trials and, eventually, commerciality. To be sure, industry is already carrying out and collaborating with other stakeholders on research into various areas of relevance to Qatar such as water sustainability, desalination, solar and synthetic aviation fuel.

The Qatar Shell Research & Technology Centre (QSRTC) at QSTP, for example, collaborates with Texas A&M University Qatar on joint research into new products that exploit the properties of sulphur – a common by-product in oil and gas, also at Shell and QP's gas-to-liquids (GTL) facility. The project specifically looks into monitoring and evaluating the performance of asphalt mixtures containing sulphur based on Shell technology, and is highly relevant in Qatar's hot, desert climate.

But to align national and international energy R&D stakeholders' mandates truly successfully in the long term, new dedicated platforms will need to be created that help identify the areas where collaboration for joint industry projects is most feasible and promising in terms of producing locally-relevant results. Complementing this with clear procedures and frameworks covering intellectual property rights and the commercialization of research will then go a long way ensuring that IOCs will become less hesitant entering into joint industry research projects – which today remains the case due to concerns or legal limitations, or both, related to sharing proprietary knowledge and technologies.

While much progress has been made in terms of physical infrastructure and putting

“ The QSRTC water lab will also contribute to the development of young Qataris through internships and technical training. This type of capacity building in the wider education space will be critical to ensure a steady and growing flow of talent—and especially Qatari talent—into a rising number of research-related roles in the future.”

in place the foundations for a successful R&D future in Qatar, further capacity building will be integral to pursuing the country's ambition of transforming itself into a knowledge economy. To this end, Shell recently opened a water lab at QSTP that will provide technical support to Qatar Petroleum and Qatar Shell—and to the Pearl GTL plant, which produces large quantities of water as byproduct. Other companies have taken similar steps.

The QSRTC water lab will also contribute to the development of young Qataris through internships and technical training. This type of capacity building in the wider education space will be critical to ensure a steady and growing flow of talent—and especially Qatari talent—into a rising number of research-related roles in the future. Going forward, all R&D stakeholders will therefore have to intensify their efforts to build a wider innovation culture in Qatar that has its root in an education system that encourages children from a young age to pursue science, technology, engineering and maths (STEM) subjects and that would provide them with a perspective of what a career in sciences and research may hold for them.

Fostering this kind of innovation culture will require the creation of an ecosystem that nurtures creativity, talent and entrepreneurial spirit. This has been recognized in Qatar and will ensure that the country is well positioned to take on the challenges of the 21st century. Shell will be at the forefront of those contributing to the realization of these plans. ■



**Youssif Saleh, General Manager, Qatar Shell Research & Technology Centre**

## Pursuing Collaboration and Alignment Among Energy R&D Stakeholders

### Abdulrahman Al Emadi, Head of Maersk Oil's Research and Technology Centre

**OVER THE PAST DECADE**, technological advances—and sustained high oil prices—have led to the commercialization of technologies that have facilitated the development of the vast shale resources in North America and provided access to deep and remote hydrocarbon reserves that previously weren't economically feasible to develop.

In Qatar, technological innovation has, for example, enabled Maersk Oil in partnership with Qatar Petroleum (QP) to cut the flaring of associated gas to the bare minimum at the offshore Al Shaheen oil field. Minimizing gas flaring at the field has driven down CO<sub>2</sub> emissions, while the gas that's captured and transported onshore is being used to produce electricity in clean-burning gas-fired power plants. As such, the project addresses both the rising pressure on the world's environment and natural resources.

None of this would have been possible without substantial investments into research and development (R&D). Going forward, accelerating these types of R&D breakthroughs in the energy industry will be the key to unlocking the technologies needed to meet the world's fast-rising future energy needs. At the same time, existing resources need to be used in a smarter, more efficient and more sustainable manner. What it means is that more innovation will be required.

Partnerships between international oil companies (IOCs) and national oil companies (NOCs) such as the one between QP and Maersk Oil on Al Shaheen will play an important role in realizing such innovations. The field is Maersk Oil's biggest offshore operation globally and the company's involvement has opened the door to other areas of collaboration in Qatar. It is therefore no coincidence that Maersk Oil opened its first research facility—the Maersk Oil Research and Technology Center (MO-RTC)—at the Qatar Science and Technology Park (QSTP) in Doha in 2011.

The research center carries out R&D activities in three main areas, all relevant to Qatar but also of relevance globally: development of horizontal well applications to improve oil recovery; investigation of enhanced oil recovery (EOR) techniques such as gas injection and chemical flooding (Maersk Oil earlier this year launched its digital core laboratory that will support ongoing applied research efforts in the area of EOR); and research into Qatar's marine ecosystem to contribute to the environmental pillar of the Qatar National Vision 2030.

Other IOCs too have set up dedicated facilities at QSTP in recent years and are carrying out research into areas of relevance to Qatar such as water sustainability, desalination, solar and synthetic aviation fuel. However, while all these initiatives are important and relevant in their own right, it will only be through extensive and deep collaboration

among key stakeholders that Qatar will be able to meet its ambitious target to establish itself as a global energy R&D center as part of the government's broader long-term vision to become a knowledge economy.

While collaborations can take various forms, IOC-IOC-type collaborations in particular are often considered to be challenging to implement if core business areas are involved due to concerns over sharing proprietary knowledge in areas that companies compete against each other. Even though competition is essential and desirable, it will be important to establish common ground and find alignment to drive cross-industry collaboration to ensure that R&D activities have tangible impact on Qatar so that the country can reap its benefits. National institutions such as Qatar Foundation R&D or Qatar Energy and Environment Research Institute (QEERI) may be well placed to play a bridging and coordinating role between IOCs.

As Qatar's R&D strategy gathers momentum, it will be ever-more important for IOCs, including Maersk Oil, to enhance their knowledge of what the specific local R&D requirements are, which need tackling. To this end, late last year's announcement of the three priority research areas of energy, water and cyber security has been an important step. But energy companies will be keen to seek further guidance on the type of research that falls within the government's set of priorities in order to align their specific research strategies with the relevant national stakeholders in industry and academia.

To align national and international energy R&D stakeholders' mandates as closely as possible in the long term, the establishment of dedicated platforms and committees should help identify the areas where collaboration is most feasible and promising in terms of producing locally-relevant results. Such initiatives will need to be complemented by increased industry efforts to attract more Qataris, in particular Qatari students, into energy R&D – for without local human capacity, the country's ambitions may not be sustainable in the long term.

Ultimately, and as has been argued on many occasions, there is a need for a new level of collaboration and communication among all stakeholders—industry, academia and government—to achieve both Qatar's national goal of becoming a knowledge economy and achieve breakthrough R&D relevant to Qatar and beyond. ■



Abdulrahman Al Emadi,  
Head of Maersk Oil's  
Research and  
Technology Centre

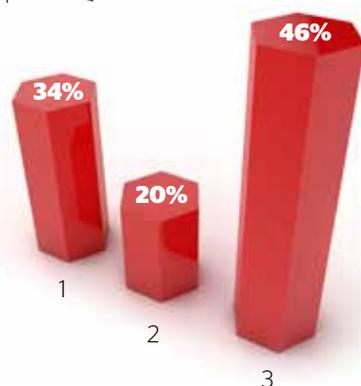
# Aligning Mandates of National & International Energy R&D Stakeholders

**Dr. Nasser Al-Mohannadi, Research and Technology Manager, Qatar Petroleum**  
**Mr. Abdulrahman Al Emadi, Head of Maersk Oil Research and Technology Centre**  
**Dr. Mohammad Ahmed Khaleel, Executive Director, Qatar Energy and Environment Research Institute & National Computing Research Infrastructure**  
**Mr. Yousif Saleh, General Manager, Qatar Shell Research & Technology Centre**  
**Moderator: Sean Evers, Managing Partner, Gulf Intelligence**

EXCELLENCE

**QUESTION 1** In successful economies, innovations are fostered and prepared for market within robust, supportive environments – ecosystems – that catalyze enterprise formation. What is the most important contribution the energy industry can deliver to create this environment in Qatar?

- 1) Drive in-country R&D through to commercial implementation
- 2) Locate mission critical research labs in Qatar that support global operations
- 3) Cooperate and coordinate with industry peers on research that has an impact for Qatar



**SEANEVRS (SE)** So on question 1, 46% voted for cooperation and coordination with industry peers and research that has an impact for Qatar. We'll talk a little bit about that on this panel, because clearly that's a challenge, if you take it within the context of IOCs cooperating directly.

Can we bring up the next question, please? Would setting up an industry committee dedicated purely to coordination of energy R&D in Qatar go a long way to facilitating alignment between energy R&D stakeholders, national and international?

**YOUSSIF SALEH** I voted for number one. Qatar Shell Research & Technology Centre (QSRTC) was the first anchor tenant at the Qatar Science & Technology Park in 2008, but we have started our activities of here in Qatar since 2006, as we were scanning the local market to understand what kind of research programs would support Qatar's priorities. And we found that Pearl GTL would be one of our main stakeholders. So we are now focusing our research programs to support Pearl GTL, the largest Gas to liquids plant that Qatar Petroleum and Shell built in Ras Laffan. Pearl GTL is as valuable asset of Qatar, as it cements Qatar's position as the



GTL capital of the World. Having this type of stakeholder helped very much. So a national institute can play a vital role.

**SE** Abdulrahman, is it appropriate to think of setting up a committee that would help with this coordination?

**ABDULRAHMAN ALEMADI** Absolutely. Creating an industry committee dedicated purely to coordination of energy R&D in Qatar would go a long way to facilitating alignment between energy R&D stakeholders, national and international. It would inevitably enhance and strengthen collaboration, all the while developing the capabilities of Qatar's people and institutions, as well as working building and maintaining a competitive and diversified economy.

**SE** Do you seek the national institutions to provide a sort of roadmap?

**ABDULRAHMAN ALEMADI** To an extent, yes. But more importantly, success depends on a unique relationship and on working towards common goals. For example, Maersk Oil's relationship with Qatar has been proven over two decades, during which time we've listened and changed to better meet the goals of the nation. It's important that all parties work in collaboration with national institutions, but that we also bring technology innovation to the table.

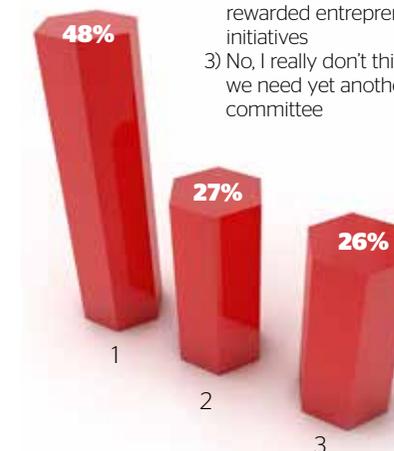
**SE** What is the mandate and priority focus of QEERI and how do you see it aligned with the other players?

**DR. MOHAMMAD AHMED KHALEEL**

In Qatar, what we really need to do is to work on industrial-driven problems such that the industry has a major role in defining the requirements for R&D. At the same time, we need the industry to be able to help us bridge the 'valley of death' between research-to-development-to-deployment. The engagement of the industry should come at the front end but also in the middle and at the end because we need to create sustainability in Qatar. To do so, it's not sufficient just to do R&D. We need to go beyond doing R&D to moving the R&D to the development, and the deployment stages. The industry really has to play a major role in defining requirements and working together. We're a small country, so it's really important for us to work together in a collaborative way.

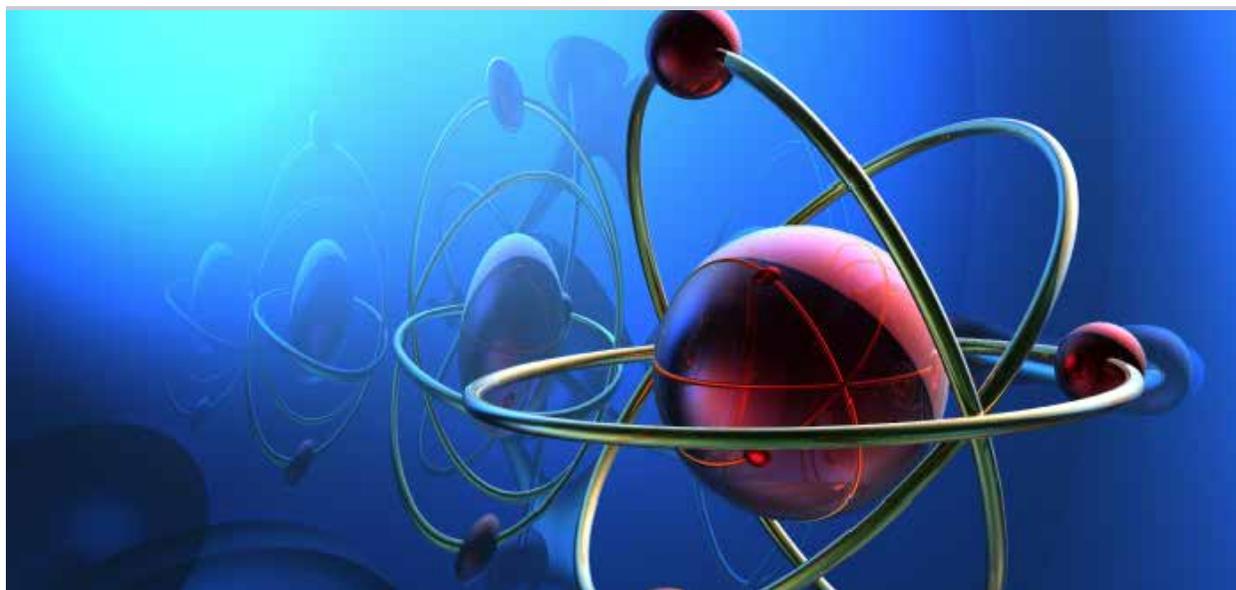
**QUESTION 2** Would setting up an industry committee dedicated purely to the coordination of energy R&D in Qatar go a long way to facilitating alignment between energy R&D stakeholders – national and international?

- 1) Yes, if a national institution defined & led the initiative
- 2) Yes, if it encouraged and rewarded entrepreneurial initiatives
- 3) No, I really don't think we need yet another committee



QEERI has a mandate to foster an excellent research culture in Qatar, across the board. But also, we have to lead the way in the development of certain technologies and R&D activities. To that end, our strategy is a three-legged strategy. First of all, our work, the R&D we need to buy down the technical risk and the deployment risk associated with the activities we're working on. Second, we need to conceive, build and operate world-class facilities. You cannot actually move the things and push us toward our aspirations in Qatar without really having world-class facilities. They're not just QF facilities—they're national facilities. This is for all of us. The third aspect is attracting, hiring and retaining the best scientists and engineers, and we have a great focus on our Qatari colleagues. We need to really embark on the journey together with them to make sure we create that sustainability.

In the last QNRS meeting we talked about two points: solar and hydrocarbon. But I think what we need really to remember here that we cannot achieve excellence without focus. So if we actually take our chips and spread them all over the globe, we cannot make progress. In terms of execution, initially, we're focusing on solar, energy storage and grid integration, which has a wholesome



of issues. But, nonetheless, we're building cross-cutting capabilities in material science, in characterization, modeling and simulation, environmental sciences that actually will address the country's challenges. Water security is a big issue for Qatar. And clearly, in these areas, our vision is not just to do the research but to populate the second swim lane, which is really the industrial ecosystem here in Qatar.

So, we need the industry, we need the universities, we need all of the partners to work together. The plans that we have are dynamic, so they can change over time. But

“You can create that sustainability. But if everything we do is outside Qatar, then we don't have research facilities and it wouldn't really get us towards the goals established by the country's leadership. So we need the facilities, but we need to do them in a thoughtful way.”

**Dr. Mohammad Ahmed Khaleel**

it really takes very productive dialogue to do that.

**SE** Dr. Nasser, when you looked at question one, creating this ecosystem, what did you vote for? And what are your thoughts in relation to answer number two, which actually got the least amount of votes?

**DR. NASSER AL MOHANNADI** I voted for number two. I think it's important to have infrastructure for laboratories that can serve the global activities in Qatar and the region.

**SE** I'm wondering in terms of Shell and Maersk, to bring mission critical research that is globally critical, not just Qatar but globally, is that a vision for research centers?

**ABDULRAHMAN AL EMADI** For Maersk Oil Qatar, our vision and our business model is inspired by Qatar's 2030 National Vision. It's about building the capacity and capabilities. We need to really start investing and building on Qataris. How do we attract Qataris into R&D? We just inaugurated the Digital Core Lab, MODC, in January and we were very lucky to have this kind of machine and technology here in-house developed in our center, which can be used by our partners, like QP, and also by academia. We also have contacts with the universities and hope that we can really utilize the machine, the equipment and the facility we have. Plus, we have the top researchers here in Qatar working in our center. So this shows our commitment to the society of Qatar for the long-term – Maersk Oil has been here since the early 1990s, working the Al Shaheen Field.

**SE** Maybe QEERI has a role to play in facilitating coordination amongst international and national companies and facilitate bringing them all to the table?

**DR. MOHAMMAD AHMED KHALEEL**

I believe so. For example, we can foster collaboration between companies by working on an industry-specific problem at the pre-competitive stage. If we come together, the companies and not just QEERI but also the universities and so on, and we talk about the industrial needs and we conduct pre-competitive research. We could have cooperative agreements between companies and institutes or universities to take it further, to more business-sensitive areas.

I voted number two on question two and the reason is because having labs and critical facilities here in Qatar is the way you can attract companies to Qatar. You can create that sustainability. But if everything we do is outside Qatar, then we don't have research facilities and it wouldn't really get us towards the goals established by the country's leadership. So we need the facilities, but we need to do them in a thoughtful way.

**SE** How do you take the position that hydrocarbon is outside of the grand challenge of energy security, which you are now tasked with shepherding?

**DR. MOHAMMAD AHMED KHALEEL:**

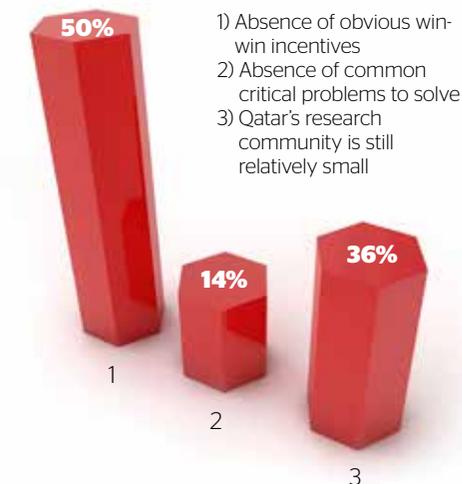
Clearly, the grand challenge encompasses solar and hydrocarbons. But focus is very important. If you cannot focus, you cannot really achieve excellence. You cannot make progress. So now we're talking about the execution, not really the notion of what is the grand challenge. Again, the grand challenge speaks about solar plus hydrocarbon. Within QEERI, initially, we're focusing on solar, energy storage and integrating these resources with the electrical grid, or developing actually off the grid capabilities.

**SE** And do you think those activities can support the activities of the hydrocarbon industry?

**DR. MOHAMMAD AHMED KHALEEL** I think the activities of the hydrocarbon industry have a different spin. We're building cross-cutting capabilities that we can work with QP, with the rest of the companies, with the universities, to address that. The capabilities, you know, the facilities and the people we're hiring – they actually will be able to work with all of our stakeholders.

**DR. NASSER AL MOHANNADI** At QP, we are focusing on the QP-operated fields, which account for around 25% and the remaining 75% of fields are operated by companies – IOCs as well as service companies that provide services for these operations. We already have a cooperation project with Total for example. Total is operating one of the fields and we, QP, are operating another field so we joint up to tackle the challenge of productivity, which both of us are facing. We have come up with an agreement because we have a common interest.

**QUESTION 3** It's much easier to talk about the need for collaboration than to implement it - which of the following is the greatest obstacle that continues to hold it back?



**SE** We'll take the third survey question: It's much easier to talk about the need for collaboration than to implement it. Which of the following is the greatest obstacle that continues to hold it back?

**ABDULRAHMAN AL EMADI** My answer was number one: it's the win-win.

**SE** So if it's in the State of Qatar's interest that Maersk Oil and Shell cooperate on some subject, does that provide an incentive?

**ABDULRAHMAN AL EMADI** Yes – and creating the right environment and opportunities for that is essential. For example, Maersk Oil's Research and Technology Centre is located at the Qatar Science and Technology Park, where we have



a world-class hub of technology innovation under one roof. We operate in close proximity to our industry peers and to various higher education institutions, it's an ideal situation for collaboration and cooperation among industry peers for the benefit of Qatar.

**YOUSSEF SALEH** Having the IOCs and national companies in one place is a unique opportunity. It's a unique facility even across the GCC. We can utilize that by collaborating with other companies especially that we have a clear agenda of what we need to achieve.

**SE** Nasser, you mentioned an example earlier that you're doing a project with Total – how did that come about?

**DR. NASSER AL MOHANNADI** The initiative came in before I joined QP, but we had other initiatives, which were similar, where we sat together and talked about areas where we needed support and wanted to have win-win situations.

**DR. MOHAMMAD AHMED KHALEEL** I think the industry plays an important role in really defining the requirements for the problems they're facing. Then there is a variety

of mechanisms that one actually can utilize to establish the research agenda. We can do it through industry-academia-institute workshops, where the industry comes into these workshops and speaks about the problems it's facing and so on. Then the collective minds in academia and the institutes, with the industry, can define the various research activities. When you talk about win-wins, we need to establish some form of public-private partnerships in which the industry also can have a say. There are plenty of examples in these areas. For example, you know, the Partnership for New Generation Vehicles in the U.S., PNGV, is a good example. You got companies who're competing exactly on the same products – GM, Chrysler and Ford – teaming up with the government to do pre-competitive research. That gives them an introduction to new ideas and first of all buys down their risk. Then, if they want to take it further, they know who's who at the universities, at the institutes that actually can help them move the activities to the next level. So, this is actually really important and we need in Qatar communities of practice. We need people to start knowing each other, what our strengths are and so on. This is really important. But you have to create a community of practice and you have to have the right venue to do it. ■



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